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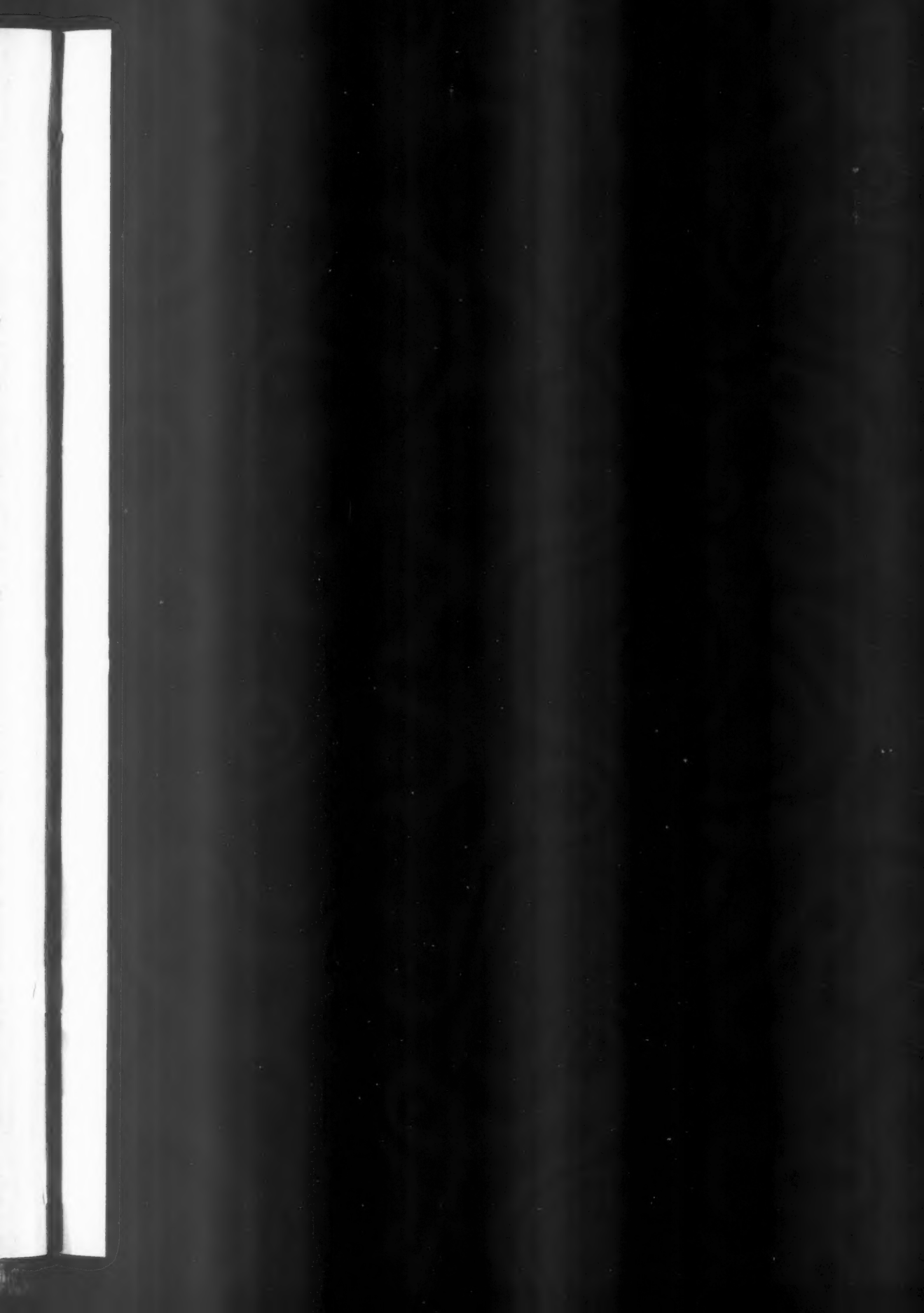

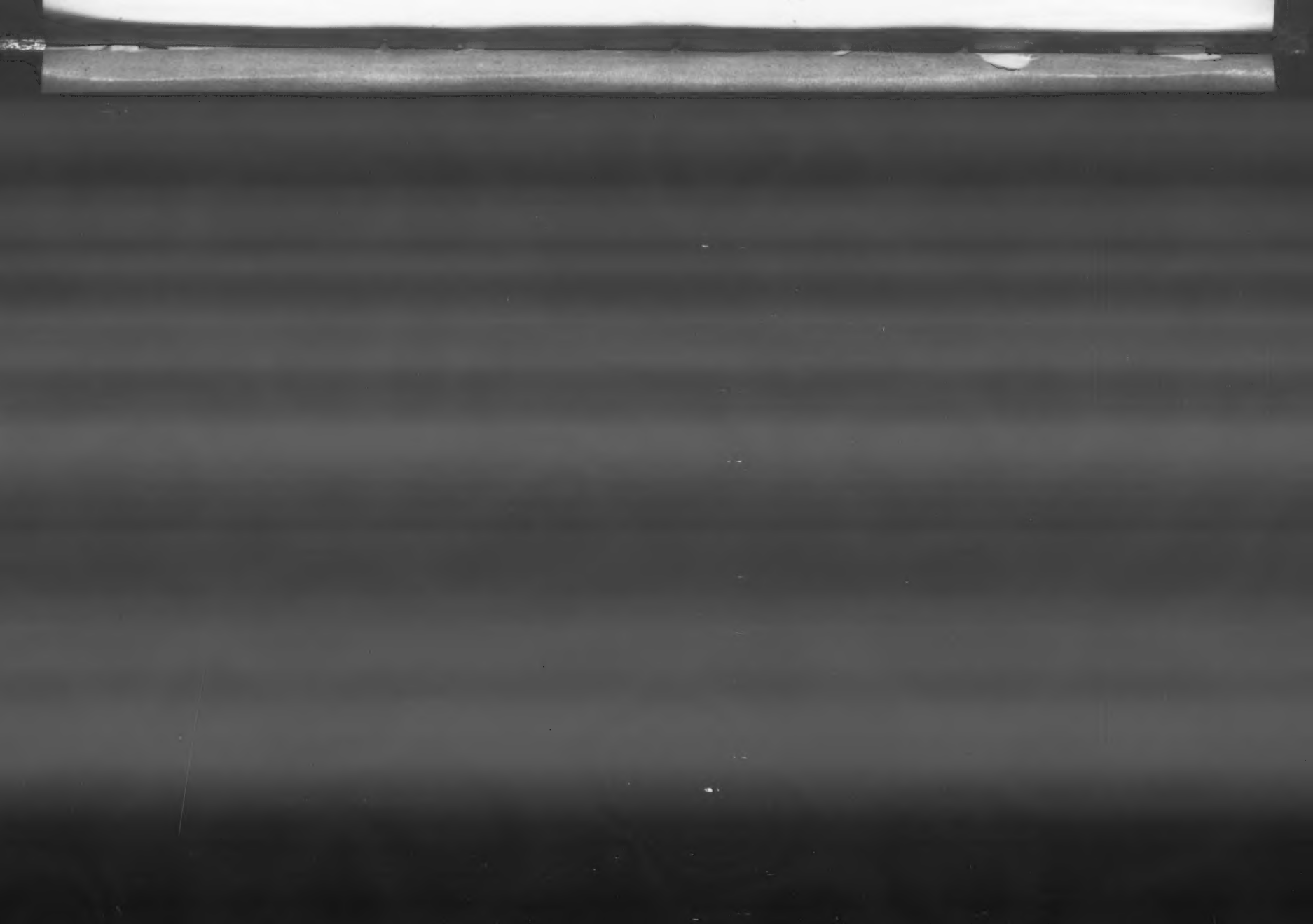

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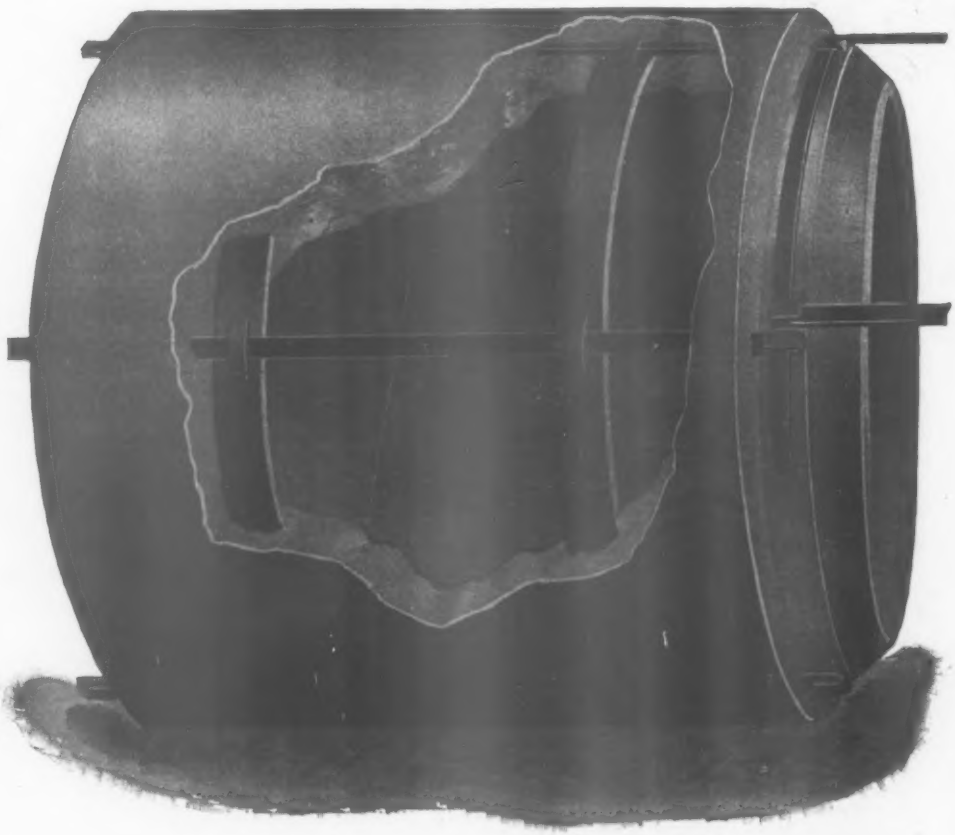

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MUNICIPAL ENGINEERING

VOLUME XXXV. DECEMBER, NINETEEN HUNDRED EIGHT. NUMBER SIX.

THE VALUE OF THE CARBENE REQUIREMENT IN ASPHALT SPECIFICATIONS.

By L. Kirschbaum, Asphalt Chemist, Chicago, Ill.

IN connection with the preparation of asphalt specifications for the city of Chicago by Andrew Rosewater, M. Am. Soc. C. E., the following investigation was made to determine the value of the carbene test which has been evolved in recent years by Clifford Richardson. This test is intended for the purpose of detecting those asphalts which have been injured by severe heat treatment in the process of refining or production. As is well known, the term carbenes has been applied by Mr. Richardson to those bitumens of asphalt which are more soluble in carbon bi-sulphide and the usual solvents for bitumen, than in carbon tetra-chloride.

The objections urged against incorporating into specifications any requirement limiting the amount of carbenes allowable in asphalts or asphalt cements, are two-fold. First, that the presence of carbenes in no way has anything to do with the heat treatment to which an asphalt has been subjected; secondly, that neither sufficient time has elapsed nor have any available data been collected to show from practical results that pavements laid with such asphalts are in any way inferior, under the same conditions, to those laid with asphalts free from carbenes.

Experiments were first conducted with Bermudez asphalt. An asphalt cement was prepared from Bermudez asphalt and a standard paraffine flux having a penetration of 120 degrees Dow. This cement upon analysis was found free from carbenes. About 125 grams of this material were placed in a 250-cc. flask provided with air agitation, and maintained at a temperature of 300 degrees F. for two hours; and again after subjecting it for a like period at temperatures of 400 degrees F., 500 degrees F., 600 degrees F. and 700 degrees F., the same material being carried through the experiment. Samples were taken at the various stages and analyzed, with results as tabulated below:

TABLE I.

Temp.	Time.	Penetration.	Bitumen.	Mineral.	Difference.	Carbenes.	Fixed Carbon.
Original		120	.....	.....	.....	None	11.27 p.ct.
300 deg.....	2 hrs.	91	95.86 p.ct.	1.72 p.ct.	2.42 p.ct.	None	11.39 p.ct.
400 deg.....	2 hrs.	42	95.95 p.ct.	2.17 p.ct.	1.88 p.ct.	None	12.95 p.ct.
500 deg.....	2 hrs.	19	96.36 p.ct.	1.83 p.ct.	1.81 p.ct.	None	14.21 p.ct.
600 deg.....	2 hrs.	*	96.85 p.ct.	1.70 p.ct.	1.46 p.ct.	None	17.90 p.ct.
700 deg.....	2 hrs.	**	94.89 p.ct.	2.14 p.ct.	2.97 p.ct.	3.87 p.ct.	25.85 p.ct.

*Hard. **Too hard and brittle to chew.

These analyses show the gradual increase in fixed carbon as would be expected to result from cracking and from the volatilization of the lighter hydrocarbons. There was no formation of carbenes until the higher temperature was reached and until a very large amount of lighter oils was driven off. With the appearance of carbenes is noted an increase in the non-bituminous organic matter.

In order to be certain that the carbenes obtained in the above experiment did not result from any hydrocarbon or series of hydrocarbons char-

acteristic of the flux, a sample of refined Bermudez asphalt was subjected to similar conditions with results as given below:

TABLE II.

Temp.	Time.	Bitumen.	Mineral.	Difference.	Carbenes.	Fixed Carbon.
Original Ber.....		95.65 p.ct.	2.42 p.ct.	2.93 p.ct.	None	13.89 p.ct.
500 deg. F.....	2 hrs.	95.73 p.ct.	.....	.....	None	.....
500 deg. F.....	4 hrs.	95.58 p.ct.	.....	.....	None	.....
500 deg. F.....	6 hrs.	95.44 p.ct.	.....	.....	None	.....
650-700 deg. F.....	2 hrs. longer	91.64 p.ct.	2.61 p.ct.	5.75 p.ct.	25.77 p.ct.	37.46 p.ct.

Analyses of samples taken at intervals stated, show that, as before, carbenes were obtained after the material had become very much hardened, and at approximately 700 degrees F., this proving conclusively that the fluxing material could not alone be held responsible as the source of carbenes, but that they resulted rather from a molecular rearrangement of some of the hydrocarbons of the asphalt, as evidenced by the cracking and increase in the non-bituminous organic matter. The material finally obtained was very hard and brittle, barely sufficiently fluid at the end of the experiment to pour from the flask. No quantitative comparison can be made between the first and second experiments, as the extent of heating was in each case different.

Analysis of the preceding data indicated very strongly that carbenes resulted either (1) from overheating alone, (2) from merely a "concentrating" or hardening through volatilization and changes of lighter oils, in the same way as asphaltenes are produced in the distillation of asphaltic oils, or (3) through the action of both high temperature and concentration.

To determine which of these conditions operated in the formation of carbenes was the object of the next series of tests. If due to a concentrating or hardening process only, it should be possible to produce carbenes at low temperatures by simply evaporating an asphaltic oil to maximum hardness. If, on the other hand, they are due to an overheating alone, it should be possible to produce them in the oil or soft asphalt merely upon application of excessive heat. For example, should a heat of 700 degrees F. be capable of producing carbenes at all, it should, if it be the sole cause of such, produce them at any stage of transition from oil to asphalt at which the material has sustained this elevated temperature, regardless of the resulting hardness.

About 150 cc. of crude asphaltic oil from Kern County, California, were exposed at a temperature of 650 degrees to 690 degrees F. in a 250-cc. flask until asphalt was produced of 63 penetration. Analysis of this material showed no carbenes. Longer exposure at the same temperature, until it was of a hardness corresponding to a harder commercial "A" grade asphalt, gave a material containing a large amount of carbenes, as evidenced by the analyses given below:

TABLE III.

Time.	Temp.	Hardness.	Bitumen.	Mineral.	Difference.	Carbenes.	Fixed Carbon.
4 hrs....	650-690 deg.	63 Pen.	99.42 p.ct.	.13 p.ct.	.45 p.ct.	None	12.19 p.ct.
2 hrs. longer....	650-690 deg.	*	95.62 p.ct.	.16 p.ct.	4.22 p.ct.	19.37 p.ct.	29.00 p.ct.

*"A" Grade, softens 300 deg. F.

It is very evident from this that heat alone could not have been the cause of the presence of carbenes, for if this were the case, the softer material first analyzed should have shown at least a small amount. It is necessary for us to admit, therefore, that the time of application of the heat and the resulting concentration of the asphalt must be an important element in this action.

In order to demonstrate whether a high degree of heat was at all necessary, 10 grams of the same oil as used above were exposed in an air oven at a temperature of 325 degrees to 350 degrees F. Samples were taken at various stages of hardness until the material reached a consistency of the brittle pitch obtained in the preceding experiment. In no case were any carbenes present, although in the brittle material finally obtained in this series, was noted a large amount of organic non-bituminous matter, indicating consid-

erable change in the nature of some of the hydrocarbons. This change is possibly similar to the "weathering" which occurs in natural asphalts through the cumulative effect of climatic heat and long exposure, by which the bitumen is gradually converted into insoluble organic compounds. This experiment was duplicated.

In the commercial preparation of asphalts, the amount of these carbenes, therefore, increases with the severity of the heat treatment and the conditions of its application. The fact that the harder grades of oil asphalts, which necessarily have been subjected to more severe heat conditions, either of degree or time of application, contain as a class more carbenes than the

TABLE IV.

Time.	Temp. F.	Run to Hardness.	Bitumen.	Mineral.	Difference.	Carbenes.
33 hrs..	325-350 deg.	Indents with nail	99.52 p.ct.	.10 p.ct.	.38 p.ct.	None
80 hrs..	325-350 deg.	Chews with difficulty	99.43 p.ct.	14 p.ct.	.43 p.ct.	None
110 hrs..	325-350 deg.	Could not be chewed; soft at 300 deg. F.	99.43 p.ct.	.14 p.ct.	.43 p.ct.	None

It is apparent, therefore, from the preceding, that neither excessive heat alone nor merely hardening or concentration is the cause of the formation of carbenes, but that both operate in conjunction to produce them. That is, with high temperatures carbenes are produced, but only until the lighter oils are driven off and a certain concentration is reached. This action may be compared to the evaporation of a sugar solution. Whatever the heat applied, no change will take place in the constitution of the sugar dissolved until such of the water is driven off as to produce a sufficient concentration; and even then no change will take place unless the temperature be sufficiently great. In a like manner, asphaltic materials here examined do not show carbenes until a concentration is reached accompanied by sufficient heat, the exact degree and conditions of which have not been quantitatively determined.

At first glance, these conclusions might seem directly contradictory to the results of actual practice. Although in the laboratory, under the conditions outlined, carbenes were not produced until a hardness corresponding to "A" grade commercial asphalt was reached, the softer "D" grade California products met with on the market contain, as is well known, widely varying amounts of carbenes. This seeming conflict can be readily understood when the fact is taken into account that in the practical production of such asphalts in stills of up to 100 tons capacity, there must necessarily result at times, depending upon the conditions of heat and agitation, a local overheating and concentration. As is well known, under similar conditions so-called "coke" is produced in preparing asphalt cement at plants, even when pure asphalts are used.

softer "D" grade asphalts, is further evidence pointing to confirmation of this fact.

At this point attention may be called to the comparative analyses of two asphalts produced from the oil under consideration at high and at low temperatures.

Time of heating (hrs.)	4	67
Temp. F. (deg.)	650—690	325—350
Yield (per cent.)	65.1	74.5
Penetration	63	68
Bitumen (per cent.)	99.42	99.64
Mineral (per cent.)	.13	.08
Difference (per cent.)	.45	.28
Carbenes	None	None
Bitumen yields fixed carbon (per cent.)	12.19	7.04
Loss 7 hrs., 325 deg. F. (per cent.)	2 15	.59
Penetration, final	26	47
Hardening (p. ct.)	58.7	30.9

It will be noted that the yield of asphalt when carefully prepared is over 10 per cent greater than when produced at the higher temperature, and that the volatilization loss and per cent of hardening are also greater under such treatment. The fixed carbon figure is of greatest interest throughout this and other analyses given. It indicates that while this figure varies with the hardness and nature of the material, for a given oil the resulting asphalts brought to the same consistency will yield a greater amount of fixed carbon in proportion to the severity of the heat treatment. When interpreted in connection with the consistency and the fixed carbon characteristics of a carefully and similarly prepared asphalt from the same source, this figure is of great value in judging of the heat treatment to which the material has been subjected.

These results, as obtained above, confirm the correctness of Clifford Richardson's conclusion that carbenes are a result of overheating. Although

in the laboratory it has been shown that certain conditions of concentration are also necessary, this condition is obtained in practice through the local overheating contingent with the firing of large stills. Agitation would, in this connection, be of great importance.

The value of a carbene requirement in a specification is obvious. While the carbenes in themselves could not affect an otherwise perfect asphalt cement, their presence is simply an indication of the care used in producing the material. It is axiomatic that an asphalt properly refined or produced at a low temperature is preferable to one produced at such a high temperature as to have become seriously changed. In this respect alone the requirement is worthy of position in a specification. The argument that insufficient data are available to prove from practical results the inferiority of asphalts high in carbenes, holds good to a certain extent. However, the fact that carefully prepared asphalts, both natural and artificial, as obtained on the market (excepting certain natural bitumens not at present used in the paving industry), are free from appreciable amounts of carbenes, is sufficient reason for discrimination against those which we know, from the presence of carbenes, are not as carefully prepared. Until practical data are available, establishing the contrary, such discrimination is just. It would be a poor physician who would expose his patient to any conditions which he had good reason to suppose were injurious. Should his patient die the result might be considered a success from the point of view of the knowledge gained, but scarcely so from a practical standpoint.

To sum up, carbenes are shown to be the result of unnecessarily high temperatures and resulting local concentration in the production or refinement of large quantities of both natural and oil asphalts. Certain asphalts having been subjected to such severe conditions as to produce important changes in the nature of some of their hydrocarbons, must at present be considered inferior to those more carefully prepared. The amount of carbenes allowable in asphalts must as yet be a matter of opinion, until sufficient data are available to determine such limits. In the meantime, unless it can be conclusively shown from practical results that asphalts high in carbenes make satisfactory pavements, a discrimination against such asphalts is, at present, logical and safe.

IMPORTANCE OF THE PROPER OPERATION OF WATER PURIFICATION PLANTS.*

By Geo. W. Fuller, Consulting Engineer, New York City.

WHEN a man buys a good watch, a good horse or a good automobile he usually expects to take good care of them in order to receive satisfactory service. If he seriously neglects or abuses them he generally expects to receive, and generally does receive, poor service.

A comparison of this type of personal property with purification plants for municipal service offers considerable room for parallelism. For some time purification plants have been designed with an increasing tendency to make them "fool-proof." Notwithstanding this endeavor on the part of designers, it is quite feasible with a well-designed and well-built purification plant to obtain poor service through improper operation. Unfortunately, there are far too many poorly operated purification plants in this country today. The purpose of this brief paper is to outline some of the more salient features of this proposition in order to keep its importance clearly in the minds of public officials in the hope of securing a higher grade of operation.

In the early years of water purification plants in this country many of them were such in name only. With the advent of the germ theory of disease and the extended investigations at Lawrence, Louisville, Pittsburg, Cincinnati, etc., there became available a considerable fund of information which served the double purpose of accentuating the importance of

*From a paper before the American Society of Municipal Improvements.

proper maintenance, and at the same time of affording a clearer conception of what was needed, both as to design and operation, in order to secure satisfactory results.

The larger plants for purifying water have, practically without exception, been provided with laboratory equipment and with a staff of attendants capable of operating the works to good advantage. It is not the intention to criticise, but on the contrary, to commend this feature of the more important purification plants in this country, and to urge greater attention on the part of smaller communities to what has been done by the larger cities with much benefit to themselves.

The importance of such operation is constantly increasing, since there is clearly a desire on the part of municipalities to secure a good public water supply, although the water at its source may be difficult to treat in many ways. A few years ago water filtration and water purification were almost synonymous. With developments in the South and Central West the coagulation of waters heavily laden with clay has become perhaps as important a matter as filtration itself, and frequently the coagulant department needs more attention than the filters. Softening of extremely hard waters is another important step in advance from the viewpoint of the consumer, and adds materially to the importance of high-grade maintenance in order to secure satisfactory results. This is particularly true where the water to be softened is taken from surface sources subject to quite wide variations in quality at different seasons of the year, as is the case of the large water softening plant recently put in service at Columbus, Ohio.

Combinations of water softening and coagulation in conjunction with filtration are also a feature accentuating the point under discussion. This feature is encountered in the Columbus plant, and is expected to be availed of to a still greater degree at the large water purification plant now approaching completion at New Orleans. It is thus seen that with the modern plant there is not only great need of competent management for the sake of efficiency, but there is also such need in order to guard against needless cost for supplies. In some cases it is quite possible with good supervision both to filter and soften a water at less expense than to filter alone with ordinary management.

In Europe water purification plants in the larger cities have been carefully operated, generally under more or less supervision from a branch of the general government, and the results on the whole have been quite satisfactory. It required the severe epidemic of cholera at Hamburg fifteen years ago in order to emphasize the importance of careful operation. It is the writer's belief that the smaller purification plants in Europe are better operated than are most of the smaller plants in this country. Directly or indirectly, this is due in considerable measure to the influence of the supervising authority and the desire on the part of the local authorities to produce results meeting with favor and not with criticism on the part of the higher authorities, who record and publish at intervals the general status of various purification plants. This supervising authority operates to best advantage when it insists upon a proper end result and when it does not interfere with details of administration which belong to the municipal government or private water company. The latter can be taught under such supervision sooner or later to take a pride in their project, and data can be secured which will lead them to make improvements and modifications with decided benefit to themselves.

From the standpoint of the water consumer, authorities in charge of water filter plants in America ought to satisfy reasonable requirements of a supervising State authority, who would have a general oversight over the efficiency of operations. The means of securing this end should lie in the hands of the local authorities, and the latter should be stimulated and assisted rather than criticised by the State authorities. The main object to be attained is that of getting safe and satisfactory filtered water at minimum expense. No good is accomplished by having various persons in authority quibbling over technical details. It is the spirit of co-operation which is needed and which will make the citizens feel that they are securing a satisfactory product without waste of money.

The writer believes that it is highly important for the members of this society to strive for the result above outlined. If the citizens of a community do not feel that their public water supply is satisfactory, it is usually possible, by a campaign of education, to overcome such ideas when they are based upon ignorance or caprice. Water consumers have a right to expect a water satisfactory as to appearance, taste and odor. Regard-

less of its hygienic quality, they will largely judge a supply by what they see themselves. For this reason the writer believes that water purification should mean not only the removal of disease-producing bacteria, but also objectionable turbidity, color, tastes and odors.

The construction and maintenance of plants capable of affording the above result can be provided for practically any water supply. Their cost is ordinarily quite reasonable in amount, and when viewed in the light of value received the expense may be called almost nominal. Expressed in cents per day per inhabitant, the total cost of a filtered water supply is so small that notwithstanding the various demands upon the treasury for modern municipal service, the people of this country will insist upon having satisfactory service, rendered without extravagance, and will be satisfied only with such service.

Included in the operation of the purification plant may be mentioned, the writer believes, the element of education of the water consumers as to the main facts in the premises. There are too many public water supplies at present judged by citizens in an unfavorable light owing to misunderstanding, prejudice and indifference. A few words from the spring water seller as he stops at the various houses may do much towards forming opinions as to water supplies, and there are various elements of public opinion which are influenced to a surprising degree by the offhand comments of those who know little about the facts.

OLD AND NEW METHODS OF ASPHALT PAVING.

By Guy B. Grant, Secretary Grant Paving Co., Omaha, Neb.

THE repaving of Douglas street in Omaha is now being rushed toward completion, and this having been the first street that was paved with asphalt in this city, I thought perhaps some description of the work as laid at that time, the materials used and the general weather conditions, as compared with the materials, tools, workmen, chemists and asphalt experts of the present day, might be of interest. The main facts of this article have been gathered from an old diary of my father's, and note books still in his possession; also ledger accounts of the kinds of materials used, and from my father's personal remembrance of the work and weather at the time this pavement was first put in.

The work was started about the 15th of October, 1882, and two blocks were finished by Thanksgiving day, when the work was shut down for the winter on account of the bitter cold weather, which has prevailed in Omaha every winter until within the last ten years, and the winters have been growing warmer and the summers cooler than ever before. The remainder was finished in the spring — six blocks in all.

The base was composed of concrete mixed in the following proportions: Eight wheelbarrows of crushed or broken stone; four wheelbarrows of bank sand and one barrel of Milwaukee cement to the batch. On top of this was laid a cushion coat, one-half to three-fourths of an inch in thickness, composed of two-thirds bank sand, one-third Missouri river sand (the bank sand carried about 8 per cent of clay), and about 18 per cent of Trinidad asphalt, mixed very soft. The screenings from the sand used in the top, or surface coat, were also thrown into the mixer and used in this cushion coat, making it, in some places, rather gravelly. When used on the street, this was simply raked and then rolled with a hand roller, no steam roller being used on this coat.

The sample that I am sending you will show how this top coat, as it moved, or contracted and expanded, has worn the cushion coat smooth and shiny. I also send a sample of the asphalt showing a section where both top and cushion coats have been cemented together, and are still in good condition. The top coat was composed of two-thirds bank sand and one-third Missouri river sand, which took the place of stone dust, and from 8 to 10 per cent of a hard mixture of Trinidad asphalt, mixed well. When brought on the street it was tamped, smoothed and rolled with a hand roller and then rolled with a steam roller weighing ten tons. It was then swept

with Milwaukee cement and barricaded against traffic. The roller used was a clumsy affair, being one of the first made.

There were no asphalt experts then as there are now, and no chemists had taken up this line of work as a specialty. The only tests made were the crude and simple ones of chewing a piece of asphalt, or rolling a piece between the thumb and fingers. By the tongue test, as the first was called, if the asphalt stuck to the teeth it was too soft and needed more hard asphalt in the mixture, and if it was hard to chew, it needed more oil. In the same way, if the asphalt was too soft, it discolored the fingers, and if too hard, it would not roll easily. The tests were made entirely by Mr. Grant, and all mixtures were made under his supervision—the entire work being left to his discretion.

In his own words: "I came to Omaha straight from Youngstown, O., where I had that spring put in the first piece of asphalt paving that had been laid in that city—about 27,000 yards—and started work here for the same concern for whom I had been working in Youngstown—A. L. Barber. The tools and equipment were crude, poorly made affairs, but they were the very best obtainable at that time, and were considered the acme of perfection. Nowadays, when the equipment for both plant and street is well near perfect, it is not surprising that the same work that it required six weeks for us to do, can be done in from ten to fourteen days. The paving on Douglas street was what was then called Class "A" asphalt pavement. This is no longer laid, but a new Class "A" has been substituted for it, composed of one inch of asphaltic concrete, or binder, and one and one-half inches of top, and at a price from 60 to 70 cents a yard cheaper. The life of the latter pavement is only from six to ten years, and requires frequent patching during that time. The pavement laid in Youngstown lasted twenty-four years, and for ten years of the twenty-four received the bulk of the traffic in the city. Douglas street in this city has lasted twenty-six years and has received the bulk of the traffic here for at least six years. By actual count an average of six thousand wagons a day passed over it for three weeks, and this was when the population of Omaha was only a fraction of what it is now. Trinidad asphalt sold at exactly the same price then as it does now, viz.: $35 per ton f. o. b. Omaha. Sand was a good deal higher, selling at that time for $1.75 per yard on board car, and was of a much poorer grade than that to be obtained now at 75 cents per yard. Stone was about 40 cents a yard higher, or $2.25 per yard. Labor was about the same price as it is now, and teams were about the same.

"The only other tests that were ever made were about one-half dozen analyses made by Prof. E. J. DeSmedt, who sometimes did a little work for Mr. Barber, but as the analysis of asphalt was, at that time, a thing not very well understood, even by the chemists themselves, results obtained were uncertain and unsatisfactory. Asphalt being a practically new commodity, commercially, very little serious study had been given it. Prof. DeSmedt was the first to take up this study seriously, and he could be called, as it were, the father of asphalt analysis, as his studies met with success in later years." His place has now been taken by the asphalt experts and asphalt chemists of the present day—Dow, Richardson and Schutte. These men have made asphalt their life work, and it is to them that any questions of moment in regard to asphalt are referred. Theirs is the court of last resort and their judgment is accepted as correct.

Machinery has been changed, modified and improved, both at the plant and on the street, until it is scarcely recognizable as being used for the purpose of laying asphalt, when compared with the plant and street equipment that was used in 1882. New patents for asphalt machinery are constantly being taken out, and the labor employed by paving contractors today is regarded as skilled labor. Work, as done then, was done by men not at all familiar with the process of laying asphalt, and who had had, with the exception of Mr. Grant and one of his foremen, no experience at all in mixing or laying asphalt. Various city engineers all over the country are now claiming that the California asphalt far exceeds the Trinidad asphalt, not only in richness of bitumen but also in durability and ease of laying; the claim is also being made for it that it will lay about twenty to thirty yards more per ton, and is easier to handle both at the plant and on the street.

Summing up the paving situation now as compared with that of twenty-six years ago, we have:

First—Improved machinery and equipment.

Second—Experts who have devoted

years of study to the subject of asphalt and its analysis.

Third—Cheaper materials, and better, as regards both sand and cement, the stone being of about the same quality.

Fourth—Cheaper and better asphalt, if the reports of various authorities are correct.

Fifth—A price from 60 to 70 cents a yard lower than it was at that time.

Sixth—A pavement whose life is only from six to ten years, as compared with a pavement that has lasted in fairly good condition for twenty-six years.

We know that in materials, machinery, experts, chemists, labor and prices there is a decided improvement, but this only applies to the manner in which the pavement is handled, and does not apply at all to the street itself, nor does it make the street any more durable, as is proven by comparing not only Douglas street, Omaha, to streets of more recent date, but also by comparing other streets that were laid about the same time, or a little later.

I would now like to ask a question and I hope that it will be answered by some expert who has made a study of asphalt and asphalt paving conditions in this country for the last twenty years, and that is: Has there been any progress made in the asphalt business except to lower the price by laying a poorer paveemnt, thereby enabling the contractors to compete in price with brick, stone and other classes of pavement? If there has been any progress besides this I would like to know just what it is, and how much of a benefit it has been to the taxpayers of this country in the way of producing a better class of pavement for them.

I had forgotten to mention that the repaving of Douglas street is being done by Mr. Hugh Murphy, one of the largest paving contractors in the West, and is not being put in under the new Class "A" specifications but under special specifications prepared by Mr. Andrew Rosewater, Omaha's city engineer, which call for a 2-inch top, and are very nearly like the old-time specifications excepting in the fact that asphaltic concrete, or the binder coat, has been substituted for the old-time cushion coat that was used in 1882.

EDITORIAL NOTE—Mr. Grant sent three samples, showing that the asphalt paving mixture of which the pavement is made is still in excellent condition, at least in part. One of the samples shows a close connection of cushion coat and top coat, the two being thoroughly incorporated one with the other along the plane of the two. The other two samples show the top and cushion coats to be entirely independent of each other. The two surfaces have evidently been rubbed together until they have received as much of a polish as the material is capable of taking, and the two surfaces are plane surfaces approaching the accuracy of contact plates of steel as closely as the difference in materials permits. Slipping of one surface on the other, either from expansion and contraction or from the rolling action of traffic on the independent top coat, has evidently produced this condition, which is materially different from that existing immediately after the laying of the pavement. One interesting fact is that in the samples the cushion coat shows no cracks on its upper surface while the top coat shows irregular cracks on its under surface, which seem to be confined to the surface and do not extend beyond the hardened smooth surface which rubbed against the similar surface of the cushion coat.

TIGHT JOINTS IN PIPE SEWERS.*

By B. E. Briggs, City Engineer, Erie, Pa.

THIS is a simple tale of my personal experience and practice. The importance of tight joints in pipe sewers was impressed upon my mind early in life in a small Western town for which I prepared plans and specifications for a sewer. It was my first experience in this sort of work and I prided myself that I had fixed the joints so that none of the sewage would get away, by providing that the pipe layer should use his hands in applying the cement mortar until the joints were evenly filled on the bottom, sides and top of the pipe, and that the joints be swabbed from the

*From a paper before the American Society of Municipal Improvements.

inside to remove any mortar that might have passed through between the ends of the pipe. The town council decided to import from a neighboring city an experienced sewer man. He proved to be a big husky son of Erin, who, after looking over my specifications, proposed to tell me "more in a minute about sewers than the person who wrote those specifications would ever know." He said: "The joints should be open on the bottom so that a portion and sometimes all the water would seep out, thereby causing less odor at the outlet," and added: "Whoever heard of a man using his hands to place mortar when trowels were made for that purpose?" together with many caustic remarks which caused my ears to burn for days.

Some 2,000 feet of sewers were laid under those specifications by the experienced sewer man from the city, but not under my supervision. So well did the contractor carry out his idea of open joints that when, several months later, I examined the work, I found to my great mortification, a small creek of spring-like water flowing from the outlet, the sewers having drained a number of wells and cisterns along their course.

The ordinary contractor is averse to making tight joints, arguing that they are an unnecessary expense. I have found it exceedingly difficult, and in many cases impossible, to satisfactorily impress on the average person that has to do with the laying of sewers, the importance of making the joints tight and I have personal knowledge of cases where due consideration was not given this important feature in sewer work by those who prepare plans and specifications for sewer systems. I recently examined a few sewers with a view of determining as near as possible the exact amount of infiltration. To my surprise I found that in one extreme case fifty-two gallons per minute was flowing from 420 feet of 9-inch sewer laid in 1896 for a real estate company. There is but one small residence connecting with that sewer.

Sewer contractors have frequently assured me that it is not at all difficult to make tight joints in a dry trench, meaning probably that the joint they make, though imperfect according to my standard, would answer the purpose under such conditions. I have found, however, that when they were permitted to use water to settle the earth on the trench, a method which I avoid if possible, there was considerable leakage into the sewer whether the trench was dry or wet.

The department of engineering of the city of Erie, which I represent, has expended during the past fifteen years a great deal of money repairing breaks in sewers and streets, caused by defective joints. In an effort to stop that financial leak on future improvements, I procured copies of sewer specifications from neighboring cities and personally experimented with every scheme suggested for making tight joints. All kinds of trouble was experienced in trying to persuade or compel the pipe layer to follow instructions and give the various methods a fair trial. The main fault seemed to lie in his failure to properly place the gasket in the socket under the pipe. For after a pipe was finally set, it was often found that the gasket, on the under side, was either out of the socket or had been caught by the pipe which was being laid and jammed between the ends of the two pipes. From the point of view of the inspection, at the top of the trench, the joint would appear to have been perfectly made. It soon became evident to me that success depended as much upon the man in the trench as upon the method. The man had to be taught and this I did by giving demonstrations.

I decided to use a fairly large oakum gasket, prepared in advance in lengths sufficient to pass around the pipe and with the ends lapped over enough to equal the diameter of the pipe. The gasket should be immersed for several minutes before using in a bucket of Portland cement and water mixed in the proportions of about 1 to 1. It should be so placed in the bucket that it can be readily removed and speedily placed in position by the pipe layer's assistant by taking one end in each hand, in which position he draws it around the end of the pipe as it is being laid, or he drops the center of it in the lower part of the socket of the pipe previously laid and the next pipe is laid on it. Then the ends of the gasket are drawn across the top of the pipe and it is driven into the annular space, working from the sides to the top, after which the joint is neatly trimmed with stiff mortar. Either manner of placing the gasket, as mentioned above, is satisfactory in a dry trench, but in a wet trench the best results are obtained by placing it around the end of the pipe as it is laid.

The greatest difficulty encountered was to procure a desirable oakum and

in such form as to insure economy and dispatch in preparing the gaskets. The common practice of using plain or tarred baled oakum, from which the contractor twisted his gaskets, proved unsatisfactory because the gaskets were of uneven thickness and could not be forced into the joint, and the tarred spun oakum was discarded because it would not absorb the cement. An investigation among the dealers in hemp, from which oakum is produced, revealed a product spun into strands, of which two or more were twisted into a loose rope called "hemp packing." It can be cut into the desired lengths with a very small per cent of waste and it absorbs a large quantity of the thin cement mortar. One strand is about the proper thickness for an 8-inch pipe, and two strands for a 12-inch pipe. By using the largest gasket that will permit the pipe to enter to the full depth of the socket and having it well filled with cement, you will make a good tight joint, although the pipe layer may neglect, as he often will, to fill the lower part of the socket with mortar.

As the joint is the weak spot in all pipe sewers and the cause of most of the trouble, I considered it advisable to eliminate as many joints as possible, which was accomplished by adopting the 3-foot lengths of pipe with deep, wide sockets in place of the standard pipe in common use. A local pipe dealer informs me that the long pipe, of 12 inches diameter, cost about 3 per cent more per foot than the standard pipe. We still permit the use of standard lengths of pipe, to some extent, when they are cemented together in pairs for about four days before laying. The difficulty of safely laying a piece 4 feet long was carefully considered, and in order to have it evenly bedded in such a position that it will not break, the contractor is required to make a soft bed in a hard-bottom trench, remove the earth from beneath each collar, and in back filling have a man stand on the pipe to detect and prevent any moving of the pipe while he tamps the earth around it, alternating from side to side, with an iron tamper similar to that used in railroad track work.

An argument in favor of laying the longer sections of pipe, aside from the fact that there are a less number of joints to be made in the trench, is that owing to their increased weight they are less liable to crawl under the weight of a sliding back fill, which, no doubt, is the cause of many open joints in wet, heavy soils.

As the greatest difficulty in producing a tight joint occurs in a very wet trench where the best possible joint is most necessary, I have devoted more time in an effort to accomplish the desired result under such conditions, and have finally adopted and required the use, in very wet trenches, of the W. S. gasket, which, I believe, is a patented article. These are made for various sizes of pipe and consist of a narrow bag of cheese cloth, slightly longer than the outer circumference of the pipe, with a strand of oakum passing through the side. Then the bag is divided into pockets by means of pasted seams, and filled with cement. The paste is readily dissolved by the water, permitting the cement in the pockets to unite as the gasket is driven into the annular space. The use of this gasket runs the cost, per joint, up to about three times that of the common oakum and cement filled joint, but an amount equal to that difference is allowed the contractor on each joint. The city furnishes the gaskets to the contractors at cost.

Another method of making a good tight joint in the water is by the use of a mixture of one part coal tar and three parts of Portland cement thoroughly mixed into a putty. After an oakum gasket is placed this putty is forced in by hand. The operation is simple and effective against the water. The workmen, however, object very seriously to the tar on their hands. The material required for one joint for a 12-inch pipe with deep and wide socket depends largely on the size of the gasket, but ordinarily one pint of tar and three pints of cement completely fill the joint. The material best suited for this work is called hydrated tar, which is crude coal tar with the ammonia water removed.

In several instances, when repairing breaks in sewers carrying a large amount of water, where it was found impossible to stop leaks at the joints with oakum and cement, I have used plaster of Paris with oakum with fair success, afterwards finishing the joint with cement mortar. The plaster is made in a thin paste and worked into the gasket until it contains all it will carry. As the plaster sets very quickly the work of preparing and placing the gasket and setting the pipe must be performed with great rapidity.

The methods outlined above have thus far proved satisfactory. Of course time alone will prove whether they are the best or not. It is, however, an indisputable fact that the

success of any method depends largely upon the intelligence and skill of the workmen. Also, that the average man working in the trench today is a very different specimen from the one of twenty years ago. The foreigner of today cannot be depended upon to understand or follow verbal instructions. I find, however, that he learns quickly by sight, and will follow a given line. It is to this fact that I attribute the success of my methods.

REFUSE DESTRUCTION IN RICHMOND BOROUGH, NEW YORK CITY.

EARLY this year a refuse destruction plant was put in operation at West New Brighton, borough of Richmond, New York City, which applies to American conditions the principles of mixed refuse destruction at high temperatures without extra fuel, which have been so successful in England.

A recent visit and full explanation of the plant by Mr. J. T. Fetherston, the superintendent of street cleaning of the borough, convinced the writer of the success of the plant. Mr. Fetherston made a thorough study of the local conditions, analyses of the refuse to be disposed of and full examinations of the various methods of disposal in use. His conclusions and the result of the decision to build the present plant are best told in some extracts from his recent report describing its construction and the results of the acceptance tests, to which are added some observations of the working conditions.

After a general review of the known methods of refuse disposal, it appeared that by mixing all household refuse (ashes, garbage and rubbish) together and burning it in a so-called destructor, following the method developed in Great Britain, this system might best meet the local situation, provided complete combustion of the organic wastes could be attained. The existing information, both general and local, concerning the character of refuse proved insufficient to determine the probable success of this method, so it was deemed advisable to make thorough analyses, calorific tests and practical experiments. During 1904, 1905 and 1906, local experimental data were accumulated and forty destructor installations were examined in Great Britain. The information thus obtained resulted in the request for bids based upon a contract, specification and general plan for a mixed refuse destructor to serve one district in West New Brighton. Bids for the furnaces, etc., were opened in December, 1906, and a type of destructor was selected after detailed analyses of the proposals. A separate contract for the foundations, buildings, runway and chimney of the new plant was afterwards entered upon, and construction work begun in June of 1907. The whole installation was completed and drying fires started in the furnaces during March, 1908. In May, 1908, a test covering the period of two weeks was carried out to determine the adequacy and sufficiency of the furnace contractor's guarantees.

Location.—While two destructors were recommended for early construction in the original report, it was decided to erect the first plant at West New Brighton. This district contains a population of about 26,000 people and covers some 4,800 acres. Land was purchased on the north side of Richmond Terrace at the foot of Taylor street, West New Brighton, about midway between the extreme ends of the district and somewhat north of the central portion, on the borders of the Kill von Kull (tidal). From southeast to southwest, the adjoining section is mainly residential, while in other directions the properties are used for industrial purposes. Vigorous protests were made before construction by householders living in the neighborhood of the proposed plant, but as no more suitable site could be obtained, it was decided to proceed with the original plans. That the opposition to the erection of the destructor was mainly sentimental has been demonstrated since the plant was started operating in March of this year, as no complaints of nuisance have been received either by the Department of Health or this

office. The nearest living apartment is located about 250 feet away from the destructor building.

Structural Work.—The building, runway and chimney shown on Plate 1 are built on a marsh containing 18 to 20 feet of soft mud, overlying a firm sand foundation. The price of various building materials at the time the plans were drawn for the structural work indicated that reinforced concrete would best meet the conditions at the site. In order to provide a working platform for a pile driver, a mattress of mixed ashes and rubbish was placed over the marsh and served acceptably for this purpose.

Piles were of built-in-place reinforced concrete type. A stout hollow steel shell with a detachable point was first driven to a firm bearing; a light inner shell was then fitted in position; steel rods with horizontal ties were inserted; the interior shell was filled with concrete and the driving shell withdrawn, leaving the concrete with the vertical steel rods held in position inside the temporary casing. The concrete piles averaged about 26 feet in length and numbered 107 in all. Two piles were loaded each with 45 tons of pig iron for test purposes and proved satisfactorily their ability to carry the loads required.

The building, runway and connecting flue were constructed in reinforced concrete, but had no particularly novel structural features. The chimney was also built of reinforced concrete, with an interior lining of fire brick for a distance of 20 feet above the base. The open spaces under the runway will later be enclosed to serve as store houses and work shops.

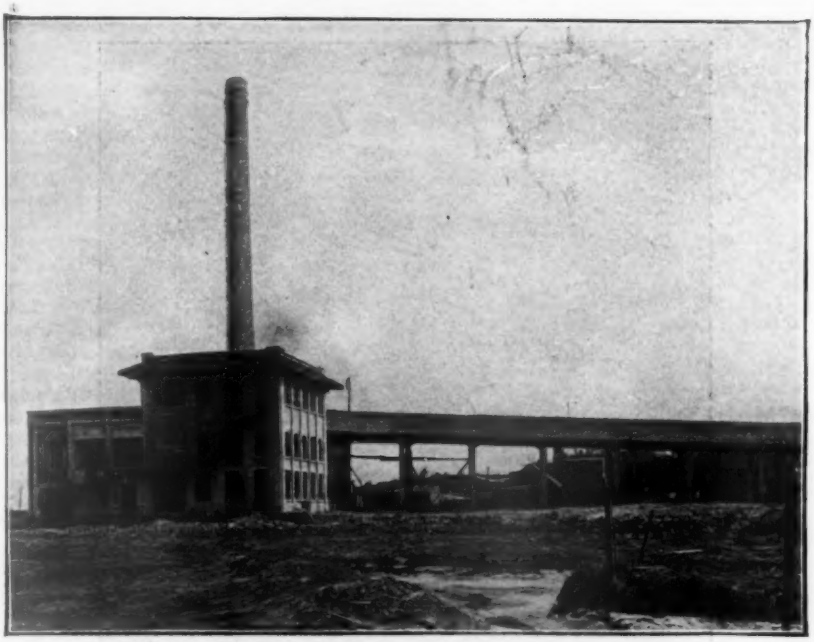
Furnace, Boiler.—The destructor proper consists of one unit of 60 (short) tons capacity per 24 hours, containing four grates with divided ashpits, each grate being served by one clinker cooling chamber. There is one 183-HP. Babcock & Wilcox water-tube boiler, without a coal grate; one air heater or regenerator, a fan for forced draft, and such appurtenances as boiler feed pumps, ventilating ducts, etc.

Carts and wagons enter the property from the street level and proceed up the inclined runway to the tipping room, after being weighed on a temporarily installed scale.

Carts tip their loads directly into storage hoppers. Wagons of the bottom-dump variety, which have recently been tried, back over the hopper on steel wheel-ways, composed of deck beams, plates and angles. When in position, the bottom leaves of the wagon are opened and the load is deposited directly in the hopper.

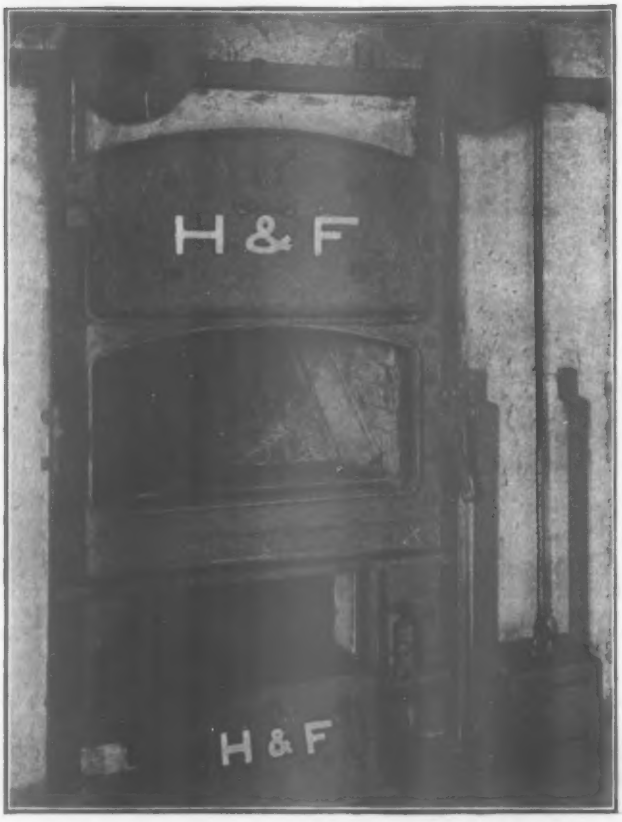
Refuse is shoveled by hand from the hoppers to the four grates, in rotation. This method of hand feeding seemed desirable in a first installation of this character, as there would be better control over the charging of the material and refuse of good quality would assist in burning the poorer kind. After the successive charges of refuse on the grate are burned, a residue in the form of clinker or slag accumulates, which must be removed at intervals depending upon the amount of incombustible material contained in the refuse. Clinker is withdrawn from the furnace while in a highly heated condition and drops through trap doors in the floor, shown in Plate II, to the clinker-cooling chambers, shown on Plate III, immediately below the furnace and on the ground level of the plant; air for combustion is passed through this highly heated material and returned to the furnace to assist in drying the new charges of green refuse. In this way, energy in the form of heat is conserved and the firemen or stokers work much more comfortably than if they had to wheel away the hot clinker in barrows, as is done in practically all British plants. After the clinker has been sufficiently cooled by the air passing into the furnace, it is deposited in wheelbarrows and removed without difficulty. At present, it is used for making land about the building. The provision of the clinker-cooling chambers was made a portion of the original specification for the destructor, and is rather a novel feature of the plant.

The gases from the burning refuse in the furnace pass over the successive grates, mix and are oxidized in the combustion chamber before entering the boiler. In other words, the furnace is arranged to secure complete combustion before the gases impinge upon any comparatively cool substance such as boiler tubes. After passing through the boiler, the gases enter an air heater, which consists of a number of pipes through which the gases pass and outside of which air for combustion in the furnace is forced by the centrifugal fan shown in Plate IV. On leaving the air heater, the gases pass to the main flue and thence to the chimney. As there is more or less fine dust contained in refuse, the destructor is arranged to deposit fine materials at various parts of the combuston chamber, boiler setting and air heater to provide against their escape



I. THE REFUSE DESTRUCTOR AT WEST NEW BRIGHTON, NEW YORK CITY.
Building and Approach.

II. THE REFUSE DESTRUCTOR AT WEST NEW BRIGHTON, NEW YORK CITY.
Front of Furnace. Trap Doors in Floor Admit Clinkers to Coolers Below.



III. THE REFUSE DESTRUCTOR AT WEST NEW BRIGHTON, NEW YORK CITY.

Clinker Grate and Ash Pit in Clinker Cooler Below Furnace Proper.

from the stack. The furnace contractors spared no expense of time or money in making the destructor the best possible in all respects.

The Tests.—As required by the specifications, a series of tests covering a period of two weeks was started in the early part of May, after the completion of the furnace and when the brickwork had been sufficiently dried by slow fires. Two mixtures, containing components of refuse representing the classes of materials collected during the two extreme months of the year (September and February), were compounded. These mixtures contained the actual weights of materials, shown in the accompanying table, which summarizes the main features of the five official tests conducted at the plant. Midseason refuse was represented by the materials as collected during the month of May. The composition of the two extreme mixtures followed the results obtained from previous mechanical analyses of refuse. Before each test was started the comparatively cold furnace was heated by means of paper, wood and a small amount of coal. Refuse was then charged until the furnace was in a fair working condition. This usually consumed from one to two hours. After the official test was started, refuse was burned for the periods indicated in the accompanying table and the test was completed when the last charge was fired and after pressure, temperature and furnace conditions were equalized.

Observations were made every fifteen minutes, with regard to the main factors involved. Combustion chamber temperatures were continuously indicated by a Fery radiation pyrometer, connected with an indicating

galvanometer. Boiler outlet temperatures were obtained by means of a Bristol electric indicating pyrometer; chimney gas temperatures were obtained by a mercury nitrogen thermometer; heated air temperatures, outside air, etc., by means of mercury thermometers. Instruments recording temperatures were compared before and after the trials. Gas samples were analyzed for carbon dioxide at intervals of 2½ minutes by an automatic combustion recorder made by Simmance & Abady, and check analyses were made by an Orsat apparatus. Steam pressures were read directly from the boiler gage and obtained continuously by a Bristol pressure recorder. Boiler feed water was measured by a meter, which was tested before and after the trials. The summary in the accompanying table gives a number of features which may prove of interest to those concerned in the disposal of mixed refuse by fire. The operating force conducting the trials consisted of one steam engineman and four stokers or firemen. Three of the stokers were employes of the local bureau who had never before worked about any steam raising plant and had never had any experience in high temperature work. They had received about one month's preliminary training in the work about the furnace. Probably, with more experienced men, even better results could be obtained than those indicated in the summary of the trials. Tests were made under the joint supervision of the furnace contractor's engineer, Mr. F. P. Rudder, M. Inst. M. E. (British) and the writer, assisted by competent observers.

After the furnace had satisfactorily met the conditions and requirements of the contract and specifications, it was accepted, and on May 21, 1908, it was taken over by the city. It has continued to satisfactorily dispose of mixed refuse during the trying summer period when the proportion of garbage is very high, and bids fair to satisfactorily perform its duty in the future.

Costs.—The capital costs of the plant were as follows:

Land (100x300 ft.)	$5,000
Foundations, building, chimney, runway, retaining wall, etc.	39,500
Furnaces, boiler, etc	23,995
Total	$68,495

There are perhaps more inquiries made concerning the cost of operation of the new plant than any other factor connected with it. In every case it

IV. THE REFUSE DESTRUCTOR AT WEST NEW BRIGHTON, NEW YORK CITY.
Blower and Engine for Forced Ventilation and Draft. Boiler in Rear.

SUMMARY OF OFFICIAL TESTS, WEST NEW BRIGHTON REFUSE DESTRUCTOR, BOROUGH OF RICHMOND, NEW YORK CITY.

Test No. of Jan. 1909.	Test No.	Description.	Refuse burned — Composition and character.		Dry refuse burned, less moisture, as per specifications. lbs.	Dry refuse burned, less moisture, as per specifications. lbs.	Total refuse burned. lbs.	Refuse burned per hr. lbs.	Ash of refuse burned per sq. ft. of grate per hr. lbs.	Residual — Clinker, etc. lbs.	Ash, etc. lbs.	Dust, etc. (by diff.) lbs.	Tins etc. (actual) lbs.	Total, (actual) lbs.	Pro-rata per cent. of gross refuse.	Gross heat value per lb. refuse.	Steam made from feed water at 212° F. lbs.	Evaporation per lb. refuse burned. Gross. Actual water value of power.	Net useful water value of power.	Temperature in ° Fahr. — Combustion chamber: Ave. deg.	Min. deg.	Max. deg.	Chim. out. deg.	Air to air heater deg.	Feed water deg.	Average steam pressure in lbs. per sq. in.	Average temperature of gases in flue at clinker. No. of cred.	Average temperature of gases in flue at clinker. min.
				%	lbs.										%	B.t.u.	lbs.												
May 6	1	Dept. stores as per specifications.	Ashes, etc.	40.6	10875.																								
			Garbage	31.7	8504.																								
			Paper	21.1	5654.																								
			Clinker	0.6	156.																								
			Glass, metal, etc.	4.5	1205.																								
			Rubbish	1.4	376.																								
			Total		100.0	26800.																							
May 8	2	Refuse as collected	Wet from rails; sample dried over steam.				16,310	16,165	49.7	8396.	707.	224.	240.	9843.	30.2	1.43	1.35	1.10	13.8	16.5	8.0	1718.	1922.	1525.	240.	31.5	297.	83.	1032	8.	8.4
			Components																												
May 15	3	Ref. mixture as per specifications.	Ashes	70.5	21481.																										
			Garbage	11.9	3628.																										
			Dust, rags, etc.	13.2	4023.																										
			Glass, Metal, etc.	4.4	1364.																										
			Total	100.0	30102.																										
May 15	4	Refuse as collected.		8%	17,400	17,225	63.7	13986.	600.	240.	240.	14372.	41.3	0.91	1.10	1.02	12.4	17.6	8.0	1698.	1904.	1593.	257.	55.0	298.	84.	130.4	7.	12.3
May 16	5	Refuse as collected.	Relatively dry, representative material		31,947	31,629	58.2	17344.	913.	477.	240.	19083.	43.0	1.00	1.31	1.12	13.9	16.8	7.0	1702.	1940.	1634.	....	....	....	84.	187.4	5.	8.2

has been stated that until the plant has been operating continuously throughout a refuse cycle (which covers a period of one year), it will not be possible to give any reliable cost data regarding maintenance charges. A full report on the total cost of collection and disposal for the district served by the West New Brighton destructor will be made when all charges are available. Statements of partial costs only prove misleading.

Though the main object of this installation, a sanitary disposal of the wastes, has been achieved, there are still many factors concerning the more effective treatment of mixed refuse at the new plant yet under consideration, such as the benefit derived from the heat abstracted from the clinker in the cooling chambers, the ordinary amount of power produced under average operating conditions, the best utilization of such power, and the most economical treatment of the other by-products, including clinker, tins, dust, etc. No decision has yet been made regarding these matters, and it is deemed prudent to postpone such a decision until sufficient information has been secured to wisely determine their most economical use.

At the time of the writer's visit the plant was disposing of 35 tons of refuse a day, which was brought to the plant in 4 wagons of 5 to 8 cubic yards capacity, which can bring 3 to 4 loads a day, and 7 2-yard carts, which can bring from 5 to 7 loads a day if necessary. The most noticeable point about the management of the plant is the thorough provision that is made for determining exactly what the plant is doing at all stages, from the weight of refuse dumped to the determination of carbon dioxide in the flue gases. The clinker from the furnaces is now used for filling the low parts of the city property about the plant and this use will last some time. Meanwhile experiments are in progress for finding uses for the clinker, such as making sidewalk blocks according to English custom and other concrete articles. There will be use for much of this class of material about the plant for some time to come.

L. L. Tribus is the consulting engineer of Richmond borough and J. T. Fetherston, the superintendent of street cleaning, has had charge of the design and construction of the plant and is now in charge of the operation.

The Power Specialty Company, New York, the American agents for the English makers of the refuse destruction furnace, Heenan and Froude, supplied the furnace, boiler and furnace appliances. Acknowledgments are made to all for courtesies, information and photographs.

STATE COMMISSIONS AND MUNICIPAL DEPARTMENTS.

By C. J. Crawford, Cape Girardeau, Mo.

WHAT is wrong with our municipal government? Each man who answers that question will aim at a different evil. What is everybody's business is nobody's business, and that is what ails the city's business.

An alderman, mayor or city official is generally regarded as an object of suspicion, a cheap politician, a ward heeler, a grafter, a spoilsman, a professional manipulator. This may be true in some cases, but in truth it is the exception and not the rule.

In the United States we have one body of Congress, 46 state legislatures and 10,602 cities and incorporated towns governed by boards of aldermen, councils or similar bodies. The people read with pride the press accounts how their idols flourish and of their grandstand plays upon the floors of our legislative bodies, and when the heat of interest has died out and the little nullifying joker shows himself almost every one has forgotten how it happened. The insincerity of our so-called great men would pale with shame and eternal disgrace the lives of most of our municipal aldermen. Our aldermanic bodies are, for the most part, composed of a miscellaneous lot of citizens from all walks and stations of life, chosen by their neighbors, of simple lives, honest in purpose, always conscious of the suspicion under which they labor and too often unduly sensitive to the least public criticism. The aldermen attend the weekly meetings of the city council and during the week are more or less engaged in looking after matters referred to the committees of which they are members. They must listen to their constituents on each question and incidentally devote what time they can to the pursuits they follow for a living. Compare this life with the lives of our congressional and legislative bodies. Visit a capitol city. See and hear the legislative body in session and see them in the afternoon and evening at the hotels and clubs. Think then of the environment of politics and of the simple life of your city aldermen and his munificent salary of one dollar per meeting.

How does this alderman vote? It is safe to say that he votes honestly and conscientously the very best he knows how. But it is probable that he knows little of the municipal question at hand. He may have visited one or two other cities in his life. His knowledge of municipal questions is limited to his experience as a member of the council. It is safe to say that men of wide opportunities for municipal observation are not seeking and will rarely accept municipal honors. It involves greater responsibilities. One's friends and future happiness are at stake for the munificent salary of say $250 per annum, the compensation of an alderman in the largest city of Iowa.

Where is the man who would leave an annual volume of business of a million dollars in the hands of nine men that he could hire for $250 each per year, or say one man for $2,250? Does anyone wonder that the taxpayers of the city of Des Moines have demanded a new form of municipal government?

Try to look up some question of municipal concern. You will be amazed at how little you can find. One would suppose that our state and federal census reports would be teeming with information and statistics upon municipal affairs covering all questions. The census report of the state of Iowa says, in speaking of cities and towns, "a series of very unsatisfactory replies was given to the question of the amount and character of the indebtedness and the assessed value of city or town property. It is evident some of the answers given refer to the actual value instead of the assessed. Inasmuch as the bureau had no means of verifying these they are published just as given on the return schedule."

It also says, "The number of parks reported is not in keeping with the

needs of the urban population of the state; the same may be said of the library facilities, although it appears that this line of effort is receiving greater attention than formerly."

The statistics of the report as to public utilities are of little or no value because of their indefiniteness. They are a travesty upon the meaning of statistical information.

The state of Iowa in its biennial reports and census, eight volumes of about one thousand pages each, has devoted thirty-five and one-half pages to the details of the following voluminous questions: Paving, libraries, parks, city debt, fire protection, electric light, gas, and water works. Otherwise the reports are complete. One will find almost everything he can think of from the value, number and kind of pedigreed hogs in each county in the state to the fish commissioner's report. All the railroad business is fully reported and the churches and the married and unmarried, but city waste and city government never bother the farmer legislator whose appropriations control the statistician.

Let us look into the annual appropriations made by the state of Iowa: Labor commissioner, $6,200; dairy commissioner, $10,600; fish and game warden, $6,000; geological survey, $8,000; historical department, $1,600; historical society, $7,500; horticultural society, $4,000; agricultural department, $3,600; agricultural societies, $13,750; Iowa weather and crop service, $2,700; farmers' institutes, $5,000; state entomologist, $1,000.

No municipal department and no appropriation for municipal study or assistance in solving or simplifying the problems of our municipalities.

In some states public service corporations of our great cities have sought extensions of their franchises in the state legislature rather than before the city council. Several states exercise control over the police forces of their cities.

The people have demonstrated their inability to elect at all times competent and efficient municipal officials. Will the people sacrifice any part of the right of ballot for economy and efficiency in municipal affairs?

The greatest evil in our present municipal government, in our smaller and medium sized cities and towns, lies solely in the lack of proper knowledge and experience of each city official, of what to do and how to do it. The council are afraid to spend any money in traveling around, to investigate, for fear the public would call it a "junket" and waste of public funds. They may get up courage to employ an expert, and when he has made a report he generally leaves his bill and a report without any recommendation, and there is still the problem before the city council. At this point the personal or corrupt influences so readily chargeable to city councils get in their work. If not, with the council working absolutely in the dark, the problem is left to take its voyage on the sea of chance to find its solution.

Municipal government presents a field for study that no man can master in two or three years in office, and what man can afford to study municipal questions on an alderman's salary? What field is open to any man to work out these questions in case he becomes proficeint in them? If he devoted himself to them during his two-year term of office you can rest assured he would never be returned to the council by his constituents.

How much better is a State Legislature to handle these problems than a city council? According to State reports of the State of Iowa for the biennial period ending in 1906 the expenditures of the State were $6,795,000. The budget of appropriations for the year 1907 of the city of Chicago amounts to the enormous sum of $49,000,000, and 1906 it was $40,000,000. This city's business is conducted by seventy aldermen, who hold office for two-year terms, and a mayor, whose term is now four years, formerly two years. Of the State expenditure of Iowa $4,925,000 is raised by taxation, or $2,462,500 per annum, which is about the total amount of taxation levied in two counties of Iowa, Polk and Woodbury. The State Legislature may have no greater business abilities and responsibilities than the city councils. Yet they have the power.

The State Board of Control saved to the State of Iowa hundreds of thousands of dollars the first year of its creation. The State Board of Railroad Commissioners exercises a certain influence and control over the railroads of the State, and the State exercises a rigid control over insurance companies and State banks throughout. The State and federal governments, at the instigation of the national and State organizations of our American municipalities, have just taken the first step in this direction of a uniform system of municipal accounting.

This idea of State uniformity, State supervision, can judiciously and prof-

itably be extended to almost every branch and question of municipal government. It must be in some way guided by unprejudiced minds free from influences, minds that are trained and experienced upon the subject at hand, competent in every way to advise cities against common mistakes and wasteful expenditures.

This can be done by creating in the State a bureau of municipalities, composed of men of competent ability each in his respective duty. Let it be the duty of this board to study all questions of municipal importance, the merits of each case, the experience of other cities. It might also be well to clothe such an organization with some authority that it might enforce upon the municipalities the right thing in case of a clash with a corrupt municipal body.

As a criterion of the trend of the public mind, during my term in public office it was almost a daily occurrence for someone connected with the city to receive some inquiry of some business men's association, some commercial club, or board of trade, or some similar body, making inquiry of our city upon municipal questions, conclusively proving that it has problems even our best business men could not solve without study.

PAVEMENT ASSESSMENTS AND COLLECTIONS.*

By E. R. Schreiter, Jr., Secretary of Common Council Committees, Detroit, Mich.

THE city of Detroit is authorized by its charter to do $300,000 of forced paving a year. That is to say, without obtaining the consent of the abutting property owners, and the purpose of this law is to prevent individuals who own large pieces or parcels of vacant property, abutting on thoroughfares which it may be desirable or necessary to pave, stopping the progress of the city in that direction, by withholding their consent from the laying of the pavement. In addition, upon petition of the owners of a majority of feet front of the properties abutting on any street, asking that the street be paved, the city invariably complies with their request and orders the street paved with such material as specified or requested by the petitioners. Petition paving, so-called, averages about $250,000 per annum.

When the preliminary steps in a paving matter have been taken, such as survey and plan, and the Common Council has ordered the street paved, bids are advertised for by the Department of Public Works and contracts awarded to the lowest responsible bidders. When the job is completed, the Department of Public Works, under whose jurisdiction the work is done, certifies to the Board of Assessors the cost of laying the pavement, based on final measurements determined by the city engineer, the bids not having been taken in a lump sum, but at so much for each yard of excavation, curbing surface, etc. The assessors then spread the whole cost of the work by an assessment against the abutting property upon a front foot basis.

The cost of paving the intersections of cross streets or in front of alleys, or a piece of property which belongs to the city, is paid by general taxation; for street and alley intersections out of appropriations specifically allowed in the general road fund; for city property the department whose property is assessed asks for appropriations to meet these assessments, which are likewise raised by general taxation.

When the assessment roll is made up, property owners are given an opportunity to examine same and make objections thereto, and if no complaint be made or protest filed, or if the complaints or protests in the judgment of the assessors are without weight or not of sufficient importance to justify their setting aside the assessment, the roll is sent to the Common Council for confirmation, and after being confirmed and approved by the mayor, it is turned over to the city treasurer for collection.

Only the original pavement of streets is paid for by special assessments. After a street has once been paved all the charges for its maintenance forever thereafter, whether it

*From a paper before the League of American Municipalities.

be for patching, repairing or resurfacing (meaning an entire new top surface), or even for an entirely new foundation and top surface, should the same be deemed necessary, is borne by general taxation. The only direct charge to the property owner is the cost of the first improvement.

After the assessment roll has been confirmed by the Common Council for the paving of a street or the construction of a sewer, it is filed with the controller, who charges it on its books against the tax collector and turns it over to him for collection. These assessments are made out in four parts, payable in one, two, three or four years, and special assessment bonds are issued for the amount of such assessments. If a street costs, for illustration, $10,000 to pave—that is, if that is the assessment against the property owners (not including inspection charges), and the amount the contractor is to be paid—there will be four bonds of $2,500 each. These bonds bear 4 per cent interest, and the city sinking fund commission, which administers the city's debt and which is charged with the responsibility for investing the money in the sinking fund, buys these special assessment bonds as they are issued by the city as an investment. The bonds are payable out of a special fund known as the "special assessment sinking and interest fund," the interest also being paid out of the same account. I appreciate the fact that possibly from a technical accounting standpoint it may be theoretically improper to use money collected from some assessment to pay the bonds of other assessments, but the way it works out is this: As assessments are collected from property owners they are credited to the special assessment sinking and interest fund. We do not attempt to keep an account in this fund with each roll, but it is all put into the one fund, out of which the bonds as they mature are paid. As a matter of fact, at the time the bonds mature all of these assessments may not have been collected; in fact, there are always some delinquents. These bonds bear 4 per cent interest, and the property owner, if he pays the assessment within thirty days, is allowed to pay at par, plus 4 per cent interest on the deferred installments of the following years; but if any installment becomes delinquent, even for one day, the property owner is obliged to pay a penalty of 5 per cent on such installment and also interest at the rate of 7 per cent on the same. The law is strictly followed in this respect and instances are indeed rare where petitions filed for relief from payment of penalty and interest are granted, unless it is a matter of worthy charity. The result is that the amount of money collected by reason of these increased interest charges on delinquent installments, which sometimes run several years, is more than sufficient to cover any little losses which may occur by reason of some defect in the assessment against some lot or the failure of some property owner to pay. We have outstanding at the present time approximately $900,000; the amount of installments which are outstanding and uncollected, plus the amount of cash on hand for liquidation of both principal and interest, will very nearly balance the bonds; we nearly always have on hand from about $400,000 to $450,000 in cash in this special assessment sinking and interest fund. When the sinking fund commission buys these bonds, they issue their check to the contractor. Many of the contractors and some of the banks have repeatedly tried to purchase the bonds; that is to say, they would prefer to take the bonds in place of the cash when the job is done; but under the terms of the contract made at the time the work is started the sinking fund commission has first call on these bonds, and the city exercises its option to deliver the proceeds of the bonds or the bonds themselves if it so desires.

The special assessment laws of the city of Detroit have been repeatedly attacked, but with no degree of success. The last and most notable contest I recall was upon the constitutionality of the law, and was made by one R. A. Parker of Detroit, who commenced proceedings in the United States court to set aside certain paving assessments on the ground that the law was unconstitutional in that "the said statutes and ordinances providing for the paving and grading of streets are in violation of the rights of the complainant under the Fourteenth Amendment to the Constitution of the United States, in that they do not provide for any hearing or review of assessments at which the property owner can show that his property was not benefited to the amount of such assessment, but that the same shall be made arbitrarily according to the feet front."

The case in question was decided against the city in the United States Circuit Court, but on an appeal to the Supreme Court of the United States,

said decision was reversed, and the constitutionality of the law sustained, the court saying "It was not the intention of the Fourteenth Amendment to subvert the systems of the States pertaining to general and special taxation; that the amendment legitimately operates to extend to citizens and residents of the States the same protection against arbitrary State legislation affecting life, liberty and property as is afforded by the Fifth Amendment against similar legislation by Congress; and that the federal courts ought not to interfere when what is complained of is the enforcement of the settled laws of the State, applicable to all persons in like circumstances and conditions, but only when there is some abuse of the law, amounting to confiscation of property or deprivation of personal rights."

At the time this litigation was instituted rolls totaling three-quarters of a million dollars were in jeopardy, and the decision of the Supreme Court was heralded with joy by our municipal officers; with sorrow by those who had expected to escape their just obligations. Since that time, some eight years ago, there has been almost no special assessment litigation, and in order to meet defects, should they at any time be found existing, an amendment to the charter was secured whereby, if at any stage in the proceedings leading up to the completion of the special assessment roll any irregularity is found, or if any roll was held to be invalid on the ground of such irregularities, it was entirely competent for the city to cure these defects by simply rescinding the old or invalid roll and make a new assessment, crediting upon the new roll the amount paid, and if said amounts so paid are in excess of the assessments as last levied, a refund is granted, and if short, the owner of the property must pay the difference. Should he refuse, his property is sold and the expense of redeeming it falls upon him; furthermore, he cannot sell the property without paying everything resting against it, as a certificate of the city treasurer to that effect must be attached before the register of deeds will record same.

THE BLOME CONCRETE PAVEMENT.*

By Harry S. Dewey, New York City.

HOWEVER divergent may be ideas upon the subject of paving, it is pretty generally conceded that the future pavement for heavy traffic, such as is encountered in the larger cities of the United States, must present a hard wearing surface capable of resisting the unusual wear and tear of present-day traffic, and also possess in no small degree the very important essential of being sanitary, that it may be approved by health and street cleaning officials. Methods of sweeping and cleaning streets are undergoing changes constantly, and those who have made a careful study of the work generally agree that no system of cleaning is satisfactory without a free use of water flushed upon the surface of the streets either by means of hose or power machines which force the water to the surface of the pavement at a pressure of from 15 to 40 pounds, the pressure depending upon the character of the surface accumulations to be removed. Under such a system of cleaning other than a hard and durable pavement will not withstand the treatment that must be applied to successfully remove the dirt which lodges in every depression, crevice and opening in the pavement, forming convenient breeding places for disease germs.

In years past, when the horse was "king of the highway," pavements possessing more or less of resiliency were deemed to be most officacious for general traffic, constructed so as to furnish the best protection to the horse, the natural inclination being to employ lighter and more elastic substances for the purpose of holding the aggregate in place to receive the wear. During the past few years, however, the "evolution of the vehicle" has demanded a revolution in road construction, particularly in the larger cities and immediate surroundings, occasioned by the unusual speed at which automobiles are now accustomed to travel, displacing the softer and more pliable materials previously used.

Taking these ideas as their text,

*From a paper before the American Society of Municipal Improvements.

the Rudolph S. Blome Company, of Chicago and New York, have evolved methods of their own in a treatment of concrete which possesses many superior advantages. The Blome method is not a creation; it is a development made through intimate knowledge of the concrete and cement business, applied to experiments covering about twelve years and obtaining results which have proven unqualifiedly meritorious. The Blome pavements have been laid under every climatic condition peculiar to the United States. In Calumet, Hancock and Houghton, Michigan, where the thermometer frequently reaches 40 degrees below zero during the winter months and often ascends to 90 degrees during the summer season, pavements have been down for three years without indicating any evidences of fracture or disintegration due to any action of the weather. What is true of this extremely cold climate is likewise true of the warmer localities, where these pavements have been in use in Southern cities for a similar period of time without showing any deterioration caused by the elements. In the city of Chicago pavements have purposely been laid in localities where the heaviest traffic conditions prevail, and after a period of from five to twelve years of constant use, show comparatively slight traces of wear and little or no tendency to break or chip; the top levels have been almost perfectly maintained and at the expiration of the guarantee period the pavements have invariably been turned over to the owners in almost as good condition as they were when first laid.

Mindful of the necessity of a careful scrutiny of every condition that is likely to affect so important a utility as a pavement, the Blome methods have taken into account the skidding tendencies of rubber-tired vehicles and a wise provision has been made to avoid this dangerous inclination of this class of traffic. By a careful treatment of the surface of the pavement immediately following the laying of the work, ample provision is made to prevent this troublesome difficulty and the results have been highly successful.

Concrete construction is not new. On the contrary, it has been in constant use for centuries, though until within the past ten years comparatively little progress has been made in the United States in the general use of the commodity, because prior to 1898 the manufacturers of cement in this country had but a superficial knowledge of cement manufacture and the high price of the foreign product prevented its use in general construction in this country. Whatever of misunderstanding there may now be can be attributed to lack of knowledge only, for the Blome development has exhibited methods and characteristics which have proven to be not only useful and lasting but also conserving needs which heretofore have been but moderately heeded.

The specifications for the Blome system of granitoid concrete blocked pavement are as follows:

Foundation: The ground shall be brought to a level eleven inches below the final level of the pavement, and then there shall be placed a layer of coarse sand or cinders four inches in thickness. This filling is to be rolled to a true surface, so that the granitoid concrete blocked pavement will be of uniform thickness throughout. The contractor must use necessary precaution in preparing the sub-grade so as to support the pavement permanently, and so that the pavement shall remain at the original grade for a period of five years. This clause will not be waived on account of any trenches or holes made in the street prior to the laying of the pavement by any corporation or private party.

All the slopes which shall be given to the street pavement shall be made in the foundation, so that the concrete work will be of uniform thickness throughout. The foundation shall be carefully compacted either by a steam roller or other suitable means at the discretion of the engineer. Then the concrete shall be put in place in the manner specified.

Materials: Cement. Portland cement shall be used and, ordinarily, will be subjected to the following inspection and tests:

Soundness: It shall meet the requirements of the "boiling" test.

Setting: The cement when mixed with 20 per cent. of water, by measure shall take the initial set in not less than 45 minutes.

Strength: Briquettes, one inch square in section, shall develop the following tensile strength: Neat, (one day in air and six days in water) 400 pounds. A mixture of one part cement to three parts sand (one day in air and six days in water) 175 pounds; it shall show a gradual increase in strength of 15 per cent. at the end of twenty-eight days.

Sand: All sand shall be clean, dry, free from dust, loam and dirt; of sizes

ranging from ⅛ inch down to the finest, and in such proportion that the voids, as determined by saturation, shall not exceed 33 per cent. of the entire volume. It shall weigh not less than 95 pounds per cubic foot. No wind-drifted sand shall be used.

Stone: All crushed stone used in making the concrete shall be of the best quality of limestone or trap rock; clean, free from dirt, broken so as to measure not more than 1½ inches and not less than ¼ inch in any dimension. The stone when delivered on the street shall be deposited on flooring and kept clean until used.

Mixing and Laying Concrete: The pavement shall consist of 5¼ inches of concrete base, and surface blocking 1¾ inches thick, making a total of seven inches exclusive of foundation.

After the sub-grade and foundation have been prepared as specified, there shall be deposited concrete composed of one part Portland cement, three parts sand and four parts crushed stone. These materials to comply with the requirements above noted, and shall be mixed by a machine suitable for the purpose, to be approved by the engineer. It shall be mixed at least six times before being removed from the mixer. The concrete shall be thoroughly tamped in place, and shall be 5¼ inches thick at all points after having been compacted. It shall be laid in sections with expansion joints (all as per the Blome Company's patents) and shall follow the slopes of the finished pavement, so that the surface blocking shall be uniformly of the same thickness at all points.

Surfacing: After the concrete base has been placed, and before it has begun to set, there shall be immediately deposited thereon the granitoid blocking, which shall be 1¾ inches thick. It will contain one part of Portland cement and one and one-half parts of clean, monument, crushed granite or trap rock. This granite shall be screened, with all dust removed therefrom, utilizing the following composition of this material: 50 per cent. of the granite to be of what is known as ¼ inch size, 30 per cent. of the ⅛ inch size and 20 per cent. of the 1/16 inch size. This proportion of sizes is essential, and must be kept absolutely accurate, as in this lies one of the essential requirements to produce proper results. This material to be mixed with the cement thoroughly, and after being wetted to a proper consistency and deposited on the concrete, shall be worked into brick shapes of approximately 4½x9 inches, with rectangular surface similar to paving blocks. This will be done by special methods, and utilizing grooving apparatus as employed under the Blome Company's patents.

Expansion Joints: Expansion joints must be provided across the pavement at distances not exceeding 75 feet apart, and longitudinally, continuously along the curb and gutter. These expansion joints shall extend through

CONCRETE PAVEMENT IN CALUMET, MICH.

the blocking and concrete and shall be filled with a composition especially prepared for the purpose.

The specifications are modified to suit local conditions and requirements.

The general idea of laying the Blome Company granitoid concrete blocked pavement is original, has eliminated objectionable features supposed to be inseparable from concrete construction, and has added novel and highly efficient methods, meeting the current demands for a pavement for modern needs. It manifestly approaches closely the requirements of today in that it provides greater resistance to the wear and tear of traffic and the elements; facilitates the ease and comfort of the weary traveler; is not noisy; retains its top level almost to the point of perfection; is almost perfectly sanitary, and is usefully instrumental in preventing the skidding tendencies of rubber-tired vehicles under all weather conditions. In the development of the Blome methods, not all experiments have been wholly successful. None, however, have been failures and progress has proceeded with splendid regularity. There should be little skepticism regarding the adaptability of concrete for paving purposes, for its ancestry contains much that is interesting and highly commendable, from the time when Rome was mistress of the world.

Sane and unprejudiced investigation of our methods is always invited, for the approval of engineers is indispensable. Irrational and biased examination is misleading, and while it cannot evoke much sincere criticism, it sometimes gives rise to prejudiced comment, which frequently indulges in a specious and fantastic arrangement of words by which a man can prove a horse-chestnut to be a chestnut horse.

One of the objects of the International Road Congress, now in session in Paris, France, is to ascertain what shall be the road of the future. Opinions may differ upon the minor points at issue, but it must be generally conceded that the demands of the situation are imperative. Our contention that a proper mixture of concrete will prove to be most available for all purposes is made after the expenditure of years of effort to perfect a pavement that would at once serve every useful purpose, ignoring no single element of necessity. To the attainment of this result the experience of the Blome Company has been carefully applied in every detail, with especial care that the need for preparation for future demands of the automobile for both pleasure and commercial requirements be not overlooked.

I believe that the comprehensive system of roadways of the future will contemplate main trunk lines generally throughout the more populous localities of the United States of similar construction to that advocated for roadways adjacent to the larger cities; that the growing demand for automobiles for commercial purposes as well as an increasing popular fancy for the high power machine so generally in use now for the titillation of jaded nerves and the rehabilitation of exhausted energy, will demonstrate the need of such a system and that the question of maintenance will hereafter receive rather more of consideration than it has previously. The initial cost of a roadway or pavement is important, but it is not of such import as to exclude consideration of the item of depreciation and the elements which now so largely contribute to cause rapid disintegration.

THE MINERAL RUBBER PAVEMENT.*

By Linn White, Engineer South Park Commission, Chicago, Ill.

THE name mineral rubber, if it attracts attention at all, must excite in the mind of the investigator the questions as to whether the qualities implied by the name are good and whether they are merited. Rubber implies that it is elastic, noiseless, dustless, non-slippery and impervious to water. Qualify it by the term mineral and we have added the ideas of permanency of strength. These are all requisites of the ideal pavement, of which I will venture to name three others: Moderate cost, ease of repair, and a smooth sanitary surface of an agreeably dark color free from glare. Other requisite qualities of the ideal pavement might be enumerated, such as the materials of which it is composed must be plentiful and easily

*From a paper before the American Society of Municipal Improvements.

obtained, the machinery required must be simple and the labor needed should not require too high a training. These, however, are implied when we say it must be moderate in cost. There is one other minor quality of the ideal pavement which should not be lost sight of, viz.: uniform consistency under a wide range of temperature. This, of course, is implied under permanency, but it is important it should be emphasized.

Granting that I have correctly named the essential qualities of the ideal pavement, the assertion is confidently made that the mineral rubber pavement embodies them to a large degree. However, lest this assertion is called extravagant, I will say what is obvious, that no pavement can be so permanent and strong that it will sustain the heaviest loads indefinitely and never wear out, nor can it be so perfectly rubbery in character that the blows of a horse's hoofs will not produce some noise.

The mineral rubber pavement may be defined as an asphaltic concrete wearing surface, resting upon a base composed of cement concrete, macadam, bonded gravel, bituminous composition, or any other sort of permanent, stable base. The asphalt, or asphaltic cement, to give the rubbery qualities desired, must be comparatively soft, of rather low melting point, showing great range of temperature and permanency under extremes of exposure. The mineral aggregate is a well-graded crushed stone and sand mixture, which may contain a proportion of gravel, but the bulk of the larger particles must be angular enough to be compressed together into a well-bonded stable mass without entirely depending upon the adhesiveness of the cement to give the bond.

As to the demand for such a pavement, it is unnecessary to say that if it approaches the ideal the demand will be unlimited. It occupies a middle position as to cost between the very high priced pavements usually laid on the expensive city streets, and the low cost methods of road construction which aspire to be classed among the so-called permanent pavements. It is elastic in more than one sense, because the character of construction can be varied by making the wearing surface thicker or thinner, the foundation of a heavy concrete or a more cheaply constructed macadam, and the stone aggregate of such a grade of stone as may be required by the conditions of travel. An old macadam road forms an excellent foundation if made free of dust or mud and has a coarse, grainy surface. The wearing surface, having a stability of its own, does not creep or roll under traffic, and if the foundation proves somewhat weak the pavement, by reason of its elastic and self-healing qualities, may be depended upon to adjust itself to the conditions.

A pavement may have one prominent, excellent quality, such as great strength or durability under iron-tired traffic, but it may be so noisy, nonresilient or full of unsanitary joints as to be accepted only in ignorance of a better or as a last resort. On the other hand, it may commend itself only by its cheapness or its smoothly coated surface and be found to be only a temporary expedient or suited only to very infrequent travel.

As the mineral rubber pavement has shown itself to occupy a conservative middle ground, capable of variation in strength and cost to suit the traffic conditions, always remaining an elastic, non-slippery, non-absorbent, nondust and non-noise producing pavement, it would seem to have before it a demand as great and a field as large as can be opened up to such a product.

The name mineral rubber pavement was given to it because, as recited above, its qualities seem to be well fitted by such a name, and as the result of an apt remark made by a city official after a section had been laid on a street over which he had charge. Observing its good qualities, he said: "I always thought I should like to build a rubber road and here I believe we have it."

If I seem somewhat enthusiastic in enumerating the good qualities of this pavement, let the enthusiasm be credited to the pleasurable emotions of an engineer who believes he has found a solution of some of the most vexing problems he has met with in his practice.

The mineral rubber pavement has been developed in Chicago. It is an outgrowth of the conditions which existed on the streets and boulevards of that city, and is the result of a conscientious effort to find some means of bettering the driveway surfaces without excessive cost. The principal boulevards of Chicago under the control of the park commissioners carry a large volume of traffic from which the heaviest teaming is mostly excluded. The boulevards in the downtown district, such as Jackson boulevard, running east and west through the center of the city, and Michigan avenue north of Twenty-second street

have long been paved with standard sheet asphalt. But south of Twenty-second street and north of Chicago avenue up to within the last two or three years the best efforts of the park management have been directed to trying to maintain macadam road surfaces. Before the advent of the automobile in such large numbers, and, I may say, before quite so high a standard of road and street construction had been set up, it was possible to do so. Well-crowned and well-drained macadam roadways 12 inches thick, the upper 4 inches of granite, bonded with limestone screenings or a natural cementitious gravel, were considered the acme of good road construction for driveways from which traffic teaming is excluded. But by, say, about 1905 it had been thoroughly impressed upon the minds of the commissioners that water sprinkled macadam roadways could not be maintained in a satisfactory condition with the expenditure of any amount of labor or money. The constant interruption of travel for repairs was one of the difficulties which had developed under existing conditions. So, in 1905, the South Park Commissioners took the lead in the experiments with various oils and tar preparations as dust layers and road preservatives. At first it was thought if the dust could be allayed, or its formation prevented, the raveling of the macadam would be stopped. Soon it was found that the lighter oil or tar liquids, though reasonably effective in preventing dust, added so little material of a binding quality to the road surface that the raveling continued. It was then realized that to get any real lasting results at least the upper layer of macadam must be penetrated and bonded together with the preservative material. This led to the use of specially prepared tar compositions and the heavier asphaltic oils, which require heat in their application. This kind of treatment has been continued up to the present time with varying and sometimes unsatisfactory results.

The Chicago boulevards and park drives carry a daily traffic of from 500 to 10,000 vehicles per day, and where the traffic exceeds 1,000 to 1,500 per day the best of the surface treatments have been found inadequate. Careful study was then made of the various paving materials and processes on the market with the result that preference was given to some form of bituminous sheet pavement with a crushed stone aggregate. This, of course, included any of the forms of tar macadam, asphalt macadam or bitulithic. As a practical expression of the preference for this class of pavement the South Park Commissioners contracted in 1907 for about 75,000 cubic yards of the bitulithic pavement. In the meantime studies and experiments were continued by the use of simpler methods. As a result the first block of what has been termed mineral rubber pavement in the South Park System was laid on Michigan avenue in May, 1908, with full confidence of good results. This block was laid with a wearing surface 2 inches thick on an old macadam base, which was given a light top dressing of new crushed limestone and rolled dry without the addition of any binder stone. Subsequently other sections of this pavement were laid in Chicago on Grand boulevard, the Lake Shore Drive in Jackson Park, the North Shore Drive and in Lincoln Park. The confidence felt in its good qualities was fully vindicated by its behavior during the past unusually hot summer, not the slightest defect or sign having been discovered in the surface.

All of the above mentioned pieces of pavement were laid on old macadam base, one block on Grand boulevard, having a wearing surface only 1 inch thick. This pavement has also been laid during 1908 in Kenosha, Wis. and Hammond, Ind.

Special attention is called to qualities of the asphaltic cement specified, as to its low melting point, not less than 180 nor more than 190 degrees, stability under temperature changes and its very small loss under the evaporation test, not more than one-half of one per cent during seven hours in oven at 325 degrees. It is such qualities as these that give it its rubbery qualities and justify belief in its permanency. Without them it would differ but little in its composition from other asphaltic concretes.

Aside, however, from the virtues of the material entering into its composition the method of laying the pavement is a large factor in producing it at a moderate cost. A portable machine has been devised which in itself is a combined drier and mixer, with melting tank for asphalt and measuring devices for the asphalt and mineral aggregate. All the working parts of the machine are enclosed so that none of the heat is lost in the processes of combining and mixing the materials. It is strictly portable, being mounted on its own trucks so it can be drawn by horses or a light traction engine.

ASPHALT MACADAM ON LAKE DRIVE, CHICAGO.

EDITORIAL COMMENT

Disposal of Municipal Refuse in the United States.

Legislation Affecting Municipalities.

The Results of the International Road Congress.

DISPOSAL OF MUNICIPAL REFUSE IN THE UNITED STATES.

The article on another page in this number of MUNICIPAL ENGINEERING on the new refuse disposal plant of Richmond borough, New York City, gives the most recent form taken by municipal disposal plants in this country, although similar apparatus has been long in use in England and in large private and semi-private establishments in this country.

Six papers on the disposal of refuse were presented before the New York section of the Society of Chemical Industry last spring by six New York engineers, which present in brief form the state of the art, mainly in this country, and the prospects for improvement. These papers have recently become available through a reprint from the journal of the society, which is published in London.

Mr. Rudolph Hering gives a brief history of the matter in this country from the first furnace to burn garbage on Governor's Island, built in 1885, and the first municipal furnace, built in Des Moines, Iowa, in 1887, to the Decarie furnace, first brought out in 1901. He also follows the reduction process from Buffalo in 1885 to the municipal plant at Cleveland, notes the incineration of rubbish in New York and calls attention to the plants for burning city refuse of all sorts, garbage, rubbish, ashes and all when collected in one mixture in Westmount, Quebec and Richmond borough, New York. He expresses some doubt, the paper being written prior to the actual operation of the Richmond plant, of the application of the last named method to American conditions without the use of additional fuel, and calls special attention to the fact that this method of incineration can be installed in the midst of populous cities, thus reducing the cost of collection by reducing the length of haul and the number of handlings.

Mr. H. B. Parsons states the principles underlying the reduction process, rubbish, garbage and mixed refuse incineration, and also works toward the location of sanitary and inoffensive plants at various points in the city in districts of convenient size as the most economical arrangement for large cities.

William F. Morse describes the smaller plants installed in public institutions and private buildings for the destruction of waste, beginning with hospitals, which burned their waste under boilers until 1890, when the first special plant was built at the Willard Parker hospital in New York, followed by numerous others. Department stores began to put in refuse destructors in 1901 and hotels and terminal stations have followed suit.

Mr. E. H. Foster briefly describes the Heenan refuse destructor, the first plant of this kind in this country being that at West New Brighton, Richmond borough, New York.

Mr. Edward D. Very gives a very readable paper briefly describing the work of the department of street cleaning of New York, which has charge of the sweeping and cleaning of streets in Manhattan, Bronx and Brooklyn boroughs, and the removal and disposition of ashes, street sweepings, garbage and other light refuse and rubbish. He recommends the methods in use for performing these duties and gives the municipal measures of the results. The ashes, street sweepings and rubbish are hauled to collecting stations on the water front, and in Brooklyn to inland stations also, while garbage is all brought to water front stations.

The first named classes of refuse are used for filling low lands at Riker's Island and near Coney Island. The garbage is taken to Barren Island and put through a reduction process.

Mr. J. T. Fetherston describes the methods formerly in use in Richmond borough, including use of ashes, rubbish, street sweepings and some garbage for filling low lands, and the burning of garbage. He gives a brief resume of the results of his investigations in a search for a better method of treating the problem, leading to the installation of the plant which is described in the article above referred to.

The general observation has been that low temperatures, such as are necessary part or all of the time in reduction plants and in plants for the burning of garbage alone, give opportunity for nuisance on account of odors, but that the high temperatures obtainable in the plants for the incineration of the mixed waste can be and are very successfully operated to eliminate all odors in the process of burning. The odors of collection, transportation, and especially of dumping are reduced to a minimum closely approximating zero by the use of proper wagons and the forced ventilation of the dumping racks and hoppers.

Even under American conditions of greater proportion of garbage to other wastes and, at least in the fruit season, greater proportion of moisture, the operation of the Richmond plant indicates that the English plan of burning of the mixed refuse is successful without additional fuel and will soon supply some steam beyond that required for the operation of the plant itself. In other words, the cost of operation of the plant is reduced to the labor and general maintenance accounts without expense for fuel, and there may even be a certain credit on account of steam furnished outside the plant. It remains to be seen whether the plant can turn out paving or other usable material at a figure which will give additional credit beyond the cost of producing such materials from the furnace clinker.

In cities where there are reduction plants which receive a subsidy from the city in addition to free delivery of garbage to the plant, the English method may readily prove a saver of money to the city, but in cities like Detroit or Chicago, where the garbage is taken by the reduction plant with little or cost to the city beyond that of collection, the reduction process seems thus far to be the cheaper. Cleveland may be running its municipal reduction plant on a like basis, but the demonstration is not yet complete. It should be remembered, however, that the reduction process takes care of the garbage only, and there may be some extra expense of separating it from the other refuse and of disposing of the other refuse which must be taken into account in making comparisons with such an institution as that of Richmond borough.

There are some indications in various cities of a desire to consider the refuse disposal question scientifically, and the success of Richmond borough, with its comparatively small problem, should give an impetus to the movement which will result in rapid improvement in the next few years. Columbus, Ohio, has been wrestling with the question for some time, but has not yet been able to get into accord its ideas of thoroughness of treatment and smallness of appropriation. This is in part due to the combination in that city of collection and disposal and the necessity of increase in expenditures for collection, which may be confused with the cost of disposal. The city has been so progressive, however, in its treatment of the water and sewage purification problems that a further step in advance in the refuse disposal problem is confidently expected. Thus the ball will be given additional impetus and other cities will see the advantages of proper study of their refuse disposal problems, in the light of the first real successes in its solution which have followed such expert investigation.

LEGISLATION AFFECTING MUNICIPALITIES.

The index of legislation of 1907, prepared by the New York state library,

has been issued and shows in thoroughly classified form the subjects of legislation for the year from October 1, 1906, to October 1, 1907. Some statement of legislation affecting subjects in which our readers are interested may be of value as showing the present tendencies.

The states of Colorado, Illinois, Nevada, Pennsylvania, Tennessee and Washington passed laws authorizing the employment of county or state prisoners on county or state roads or city streets or modified laws already existing.

Utah made city engineers in first and second-class cities recorders of maps of property. Wisconsin required external boundaries of plats to be marked with stone monuments.

Idaho, Iowa, Maine, Michigan and North Dakota passed laws affecting their state public health laboratories.

Kansas prescribed the duties of its state board of health with respect to water supplies. Maine, Massachusetts, Montana, Nevada, New Jersey and Wyoming have laws prohibiting pollution of surface waters under varying regulations and restrictions. North Carolina and South Carolina prescribed methods for forcing private and municipal water companies to remove unsanitary conditions from the watersheds from which they obtain their supplies. Washington gives the municipalities certain control over the purity of their water supplies, providing for special policemen to enforce their regulations.

State boards of health were established or re-established in Idaho and Montana; drainage commission by Minnesota; water supply or control commissions by New Jersey, New Mexico and Wisconsin; public service commissions by New York; highway commissioners by Connecticut, Idaho, Maine, Massachusetts, Missouri, New York, Pennsylvania, Tennessee, Vermont, Washington and West Virginia; railway commissions by Alabama, Colorado, Montana, Nevada, New Jersey, Oregon, Pennsylvania and Vermont; state geological surveys by Colorado and Florida; and state engineers by California, Nevada, New Mexico and South Dakota.

With respect to municipal charters, New Jersey and Alabama have commissions to prepare general forms of municipal charter. Iowa, Kansas, North Dakota, South Dakota have adopted the commission plan of government for the larger cities, mostly subject to adoption by vote of the city. Iowa includes initiative, referendum and recall. Minnesota provides for home-rule charters; Wisconsin is preparing a home-rule charter for Milwaukee; New Jersey provides a uniform charter for cities of 12,000 to 20,000 including the referendum. Special charters are issued by California, most of which provide for initiative, referendum and recall. Connecticut, Florida, Georgia, Maine, New York, North Carolina, Tennessee, Vermont and West Virginia each issued a number of special city charters or revised and amended existing charters.

Missouri, North Carolina, North Dakota, South Dakota and Washington passed laws relative to fees or compensation of county surveyors and details of their duties.

Cities and towns in Illinois, Kansas, Minnesota, New Jersey and Wisconsin were obliged to secure legislation authorizing the purchase, condemnation or issue of bonds for erecting city buildings. There are many laws regulating the details of municipal operations, even down to house connections with sewers, showing that municipalities in most states are very far from any measure of home rule, but are subject to the whims of legislatures willing to pass anything having certain backing and with little or no knowledge of the real effect of the legislation they put in force. In the list of states so treating their cities, as shown by the list of bills affecting public improvements, are Alabama, California, Colorado, Illinois, Iowa, Kansas, Massachusetts, Minnesota, Missouri, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Dakota, Pennsylvania, South Carolina, Texas, Utah, Vermont, Washington, Wisconsin.

That the highway question is a live one is shown by the list of 245 laws on this subject, not including streets in cities and towns, which are reported from 39 states, ranging in number from one each in Delaware, Georgia, Montana and Utah, to 17 in Wisconsin. The others showing most activity in this line are Michigan with 16 laws, Indiana with 15, Missouri and Pennsylvania with 14 each, Nebraska and New York with 13 each, Minnesota with 12 and New Jersey with 11. Rhode Island and South Carolina were the only states whose legislatures met in 1907 which did not legislate concerning country roads.

The subjects of the laws are numerous and include such items as state road systems, state aid, road officers, districts, machinery and materials, locating, opening, altering and vacating roads, road taxes and work, joint roads, bicycle paths, toll roads, automobiles, cleaning, watering, oiling and draining roads, fences, hedges, guide posts, obstructions, trees, weeds, wide tires, etc.

THE RESULTS OF THE INTERNATIONAL ROAD CONGRESS.

The International Road Congress, held in Paris in October, was attended by some 2,000 delegates, less than 20 per cent. of whom were from English speaking countries. There were some peculiarities of management and some failures in detail which indicated lack of familiarity of those responsible for the gathering with the needs of such a large collection of representatives from so many countries. Nearly thirty governments were represented by some eighty of their road making experts, besides the numerous unofficial representatives.

The consensus of opinion was that past methods of construction of roads have been put in the background by reason of the enormous development in the use of self-propelled vehicles, slow and heavy, light or heavy and rapid, with hard, soft, solid or pneumatic tires, the different varieties requiring different treatment of the road foundation or surface and all of them demanding improvement of existing methods.

It was also clear that the use of tar or oil emulsions on road surfaces was generally considered as really efficient, but only for a short time and can be considered mainly for special occasions. The experiments and the experience in practical use are such, however, that there is promise of further development in this line which is sufficiently bright to warrant further expenditure of time, money and ingenuity in devising new materials and new methods of applying the old materials.

The congress was not willing to put itself on record as unqualifiedly recommending the use of tar incorporated in the road material, mainly because the American uses of this material were not fully reported upon at the meetings and the English engineers were not willing to apply the results of their experience to conditions existing in other countries concerning which they were not fully informed. It seems that nearly all of the development in this class of road paving has been made in England and the United States.

The recommendations for the roads of the future are hardly applicable except in thickly populated districts, of which this country has few, except those near large cities and in concentrated manufacturing districts of the east. Practice in these district is approaching quite closely to the program of the congress, which includes hard, tough, resistant surfaces, which are not slippery, width of roadway of about 20 feet, moderate gradients and crowns, open view of all dangerous places, including road and railroad intersections, and trees along the sides of the roads.

The effects of automobiles on roads were enumerated, both those of rapidly moving automobiles, with and without attachments for increasing traction and reducing skidding, and those of heavy commercial automobiles with tires too narrow for the loads on them.

On the whole the feeling seems to be that the congress is merely prelim-

inary and that its labors were introductory and did not lead directly to any material advance in the amount of information or the development of the science of road building. A foundation is laid, however, and the formation of the International Road Bureau, in which an American representative, Mr. Logan Waller Page of the Office of Public Roads in the U. S. Department of Agriculture was active, will give opportunity for further and more complete international interchange of experiences. The congress was invited to hold its next meeting in Brussels

THE QUESTION DEPARTMENT

Books on Tunneling.

Where can I find the most accurate information on the cost of tunneling in solid rock, say, 15 feet by 20 feet high, and could you supply the book?

G. P. N. S., Attica, Ind.

The classic on tunneling is Drinker's "Tunneling," which will cost $15 to $20, as the book is out of print. Next to this is a recent book by Prelini, which contains a large number of working drawings and figures, the price of which is $3, and Stauffer's "Modern Tunnel Practice," the price of which is $5. Sim's "Practical Tunneling" is an older book, the price of which is $8. There are several books on rock and earth excavation which also contain information of some value, such as Gillette's "Rock Excavation Methods and Cost" ($3).

Southern Location for Cement Block Plant.

I am wanting to look up the business of making cement blocks with a view to locating a plant at some point in the South, preferably, where the field is not already thoroughly worked.

E. K. S., Evansville, Ind.

This question is referred to our readers with request that they send us information about possible openings in this line. No particular open location is known to the writer, but there is a place in almost every growing Southern city for a good block plant. Those in such cities as Chattanooga, Nashville, Memphis, have large business. It is not advisable, however, to go into a town where a poor plant has been or is in operation, unless one has capital enough to stand by the business until he can show the high quality of his product. The craze for cheap blocks, for which the machinery salesmen have been largely responsible, only three or four companies being excepted, has resulted in a popular prejudice against the blocks, which extends to the insurance men, and this must be overcome to some extent even in a plant in a town where the blocks have not been used before.

Silicate of Soda as Waterproofing for Concrete.

Do you know of any one using soluble glass in making concrete blocks, and if so what proportion of water is used to dilute it? I do not think that it would stand to have the face of the block made with the mixture of it, because the acids in the air in cities would affect the alkali it is made of, but back of the regular facing it might make the block hard and impervious to water. Carey of Philadelphia in his "Chemical Technology" says that chalk can be used with it to make a stone hard enough to receive a high polish and makes me think that if that can be done it would make a fine backing for concrete blocks and, making them harder, they would stand a greater pressure before requiring reinforcing.

R. F. R., Richmond, Va.

Soluble or water-glass is silicate of soda or potash or a double silicate of the two, and is soluble in hot water, retaining its solubility after cooling. When it is used to protect stone from disintegration, it apparently produces a chemical action with the air or the constituents of the stone. Thus in sandstone the carbonic acid in the air takes away the soda or potash and leaves the insoluble silica surrounding and protecting the particles of stone in the sandstone. In limestone an insoluble compound with lime or magnesia may be formed by the reaction of the carbonates in the stone and the applied silicate which hardens the stone and makes it more nearly impervious as well as more resistent to the action of the weather. This is not always the case but an application of hydrofluosilicic acid in a weak solution is said to aid in the process. A recent French invention in this line consists mainly in the saturation of the surface with hydrofluosilicic acid, although this use of that acid has been

known, with reference to the protection of stone, for perhaps forty years. It also applies certain fluosilicates to the surface of the stone, which produce chemical actions in the stone, resulting in a hardening of the stone and closing up pores.

Practically the same action probably takes place in a cement surface as in a stone surface. More or less soluble salts may also be formed, which will dissolve out and produce efflorescence on the surface if not positive discoloration.

As to the use of the silicate of soda in the body of the concrete, the "Handbook for Cement Users" ($3) reports that Prof. W. K. Hatt added silicate of soda to the water used in mixing mortar and diminished the permeability of the concrete 50 per cent, but at the same time the strength of the concrete was diminished 50 per cent. Apparently, therefore, it is safer to apply the silicate with a brush to the hardened surface than with the water in mixing the concrete.

There are several waterproofing compounds on the market which seem to have the soluble silicates as their basis, in at least one case the applications being followed by brushing on a solution of calcium chloride, thus producing insoluble silicate of lime and soluble common salt, the former remaining in the pores and the latter dissolving out so far as it can from the surface, which is rendered at least partially impervious in the process.

Can our readers report their experiences with the use of silicates in waterproofing and hardening concrete?

Salt and Sea Water for Mixing Concrete.

I should like to know if you have any work or article in your magazine giving an account of the use of sea water in mixing with Portland cement and sand in the winter time to prevent freezing, scaling, cracking, etc. There seems to be a great difference of opinion about their use and effect. The universal use of concrete made with Portland cement would seem to call for some exact experiments in this regard. Some use hot water in mixing same; some use sea water; some use salt mixed in cement; some dissolve the salt first, etc. Now, have you in print a set of experiments giving the results? If you have such, I would like to get it. If not, your great interest in this subject would warrant you in having some engineers at a college, for instance, to make them.

H. P. F., Circleville, O.

These questions are discussed in some articles in MUNICIPAL ENGINEERING, vol. xxii, pp. 91 and 230; vol. xxvi, p. 413; vol. xxviii, pp. 378 and 449; vol. xxix, pp. 424 and 426; vol. xxx, p. 441; vol. xxxi, p. 54. Results of experiment and observation are there given and reference may be made to them for the details. The general opinion formed from the study of these and similar experiments is that salt and sea water will not seriously injure the concrete mixed with them, the quantity in such mixtures being too small to produce appreciable results in the concrete itself.

But, regarding masses of concrete immersed in the water, the alkalies in sea water and, according to some observations, common salt disintegrate concrete made with cements having large proportions of alumina in their composition. This deleterious effect is prevented so far as sea-water is concerned, by using cements in which the alumina is, at least in part, substituted by iron oxide. The substitution of puzzolan or slag cement of proper composition for a part of the Portland cement before mixing the concrete seems to produce a combination not affected by sea water.

The differences of opinion regarding the methods to be used to keep concrete from freezing before it sets are largely due to the differences in the methods of manipulating the ingredients, and covering or heating the concrete or the air surrounding it so as to keep it warm enough to set in the time which can be conveniently allowed for that process. Some instruction in this line will be found in the articles referred to and also on pp. 107, 211, 244 and 248 of the "Handbook for Cement Users" ($3).

Books on Reservoir Building.

I want to build a reservoir and may use masonry, earth or concrete, and do not know yet which. Please advise me which books give the best information about these three kinds of dams. I want information about reservoirs, pipe laying, how to get the water into and out of the reservoir. Who sell cast and wrought iron pipe from 4 to 6 inches diameter for reservoir use?

J. W. G., Pompeii, Pa.

Following are the names of a number of books on construction of dams and reservoirs. It is difficult to say which will be the most nearly applicable to the conditions stated:

Schuyler's "Reservoirs for Irrigation, Water Power and Domestic Water Supply" ($5), with an account of various types of dams and the methods and plans of their construction.

Wegmann's "The Design and Construction of Dams" ($5), including masonry, earth, rock-fill and timber structures and the principal types of movable dams.

Beardsley's "Design and Construction of Hydro-Electric Plants, with Special Reference to the Design of Dams," of wood, metal, cement, reinforced concrete.

Courtney's "Masonry Dams From Inception to Completion" (9 shillings, English).

Bassell's "Earth Dams" ($1).

Gould's "Specifications for Dams and Reservoirs" (25 cents).

Books which devote several chapters to dams and reservoirs are:

Frizell's "Water Power" ($5).

Fanning's "Hydraulic and Water Supply Engineering" ($5).

Turneaure and Russell's "Public Water Supplies" ($5).

See the "Business Directory" published in each number of MUNICIPAL ENGINEERING for names of dealers in water pipe, under headings "Pipe Manufacturers," "Water Pipe," "Culvert Pipe," "Culvert Pipe, Cast Iron," "Cast Iron Culverts," "Culverts."

Is This Clay Good for Brick Making?

One of my men who is living in the country brought me the other day a piece of blue clay (dark blue when wet), very clean. There is no sand nor earth in it. It is in a bed 20 feet high. Can you tell me if this clay is good for manufacturing brick? There exists also near that place fine shale. To whom can I send samples of this clay and shale to find out what I can do with them?

J. I. B., ———, Canada.

Chemical analysis of the clay will give some information about its qualities, and reference may be made to the "Business Directory," printed in each number of MUNICIPAL ENGINEERING, for names of chemists, under the headings "Chemical Tests," "Chemists, Cement," and "Chemists, Consulting."

There are a few men who have made a special study of clays for brick making who might give good advice, such as Marion W. Blair, 316 Y. M. C. A. building, St. Paul, Minn.; Prof. Edward Orton, Ohio State University, Columbus, O.; Prof. A. V. Bleininger of the U. S. Geological Survey, Champaign, Ill.

But after the chemical analysis and physical examinations have been made it will be necessary to make special tests in actual manufacture to determine the best methods of making and burning the clay to produce a good product, and it may be found that the clay cannot be handled at a profit although the chemical examinations have shown favorable results. There are some characteristics of the clay for brick making purposes which cannot be determined by analysis.

Meter Rates in Small Water Works.

Will you send me some meter rates in small water works? We are thinking of putting in some meters in our works and would like to see how others charge for water so measured.

D. A. H., ———, N. Y.

There are not many towns of less than 2,000 inhabitants which use meters. In those in New York and New England whose rates are at hand, mainly in the "Manual of American Water Works," the following charges are made:

One charges 80 cents a thousand gallons with a minimum of 13 cents for large quantities.

Five charge 50 cents with minimum ranging from 8 to 25 cents or subject to special contract for large quantities.

One charges 43 cents.

Four charge 40 cents with minimum of 15 cents or on special contract.

One charges 35 cents with minimum of 20 cents.

Twelve charge 30 cents with minimum of 6 to 20 cents or special contract.

One charges 28 cents with minimum on special contract.

Five charge 25 cents with minimum of 5 to 16 cents or special.

Seven charge 20 cents with minimum of 3 to 16 cents.

One charges 15 cents with minimum of 8 cents.

The popular rates are in order 30, 20, 50 and 25 cents.

The collection of rates was not carried farther because the conditions in the New York town from which the inquiry comes are probably nearest those in the towns used above.

In any particular case there should be some attempt at least to determine the cost of furnishing water, including operation and maintenance, interest and sinking fund, cost of reading meters and keeping and collecting accounts, and a liberal allowance for contingencies, and the rate chosen should be as close as convenient to the cost per thousand gallons with an allowance for reasonable profit.

Tests of Strength of Washers.

I wish to make some tests on iron washers. My aim is to determine whether the material in washers can be reduced without reducing the strength. At the same time it may be necessary to design new styles of washers. Can you aid me in any way, either with suggestions or with any information on previous tests? H. M. S., ———, N. Y.

Can our readers refer our correspondent to any tests of iron washers? He does not say whether the washers are to distribute pressure over wood, iron or other surfaces, in which cases the crushing strength of the material on which the washer rests might be more important than the strength of the washer, or whether the washer is to serve as a base on which the nut is to turn, thus saving friction on the material in the body of the machine, in which case the frequency of use of the nuts and consequent rate of wear of the washer might be more important than its actual initial strength, or whether the washer is simply a filler, etc. However, he will doubtless be glad to receive reports of any tests that have been made.

Ordinance Governing Street Trees.

Can you give me some light on a prospective ordinance covering parking our city's shade trees? We are contemplating an ordinance putting all our trees in the hands of a commission.

J., Crawfordsville, Ind.

The general incorporation law of Indiana for cities and towns has provisions placing street trees in the control of the Park Commissioners in those classes of cities having this body, but the law probably does not apply directly to cities the size of Crawfordsville. An ordinance following the provision could doubtless be

brought into operation in that city, however, if it were judiciously enforced until the citizens became accustomed to it. The article on "Practical Results of the Municipal Control of Shade Trees," in MUNICIPAL ENGINEERING, vol. xxxv, p. 295, one on "Municipal Control of Planting and Care of Shade Trees," in vol. xxxi, p. 377, and one on "Care of Shade Trees," in vol. xxxiv, p. 70, will give some valuable hints.

Can our readers supply our correspondent with any ordinances governing the care of street trees which are now in force and some report of their success?

American Society of Municipal Improvements.

At the last convention of the A. S. M. I. there was some talk to the effect that members might publicly recognize the value of the society by naming it on their letterheads and cards as is done by members of the American Society of Civil Engineers. What do you think of the proposition, and how would you abbreviate the name? B., ———, Pa.

Members of the society at the same time give themselves a certain standing and make the association better known by using the statement referred to on letterheads and cards. The society is not so well known that M. A. S. M. I. is always sufficient to identify the association, and in fact it seems almost necessary to print the name quite fully, say "M. Am. Soc. Municipal Improvements." This custom is now followed by a number of members and may well be followed by the others.

Municipal Ownership of Water Works.

Have you any data as to the number of water companies in the United States owned or operated by municipalities, the success of these ventures in municipal ownership, etc.? We believe municipal ownership to be a good thing, but would like to get some reliable statistics, and would gladly pay for such information.
P. B. W., Salem, Ore.

The "Municipal Year Book" ($3) gives a list of 766 cities and towns of more than 3,000 population which own their water works, as compared with 661 places served by private companies. The "Manual of American Water Works" ($3) gives data regarding these plants and a table of water rates. The date of the first mentioned book is 1902 and of the second 1897, so that the details of information are not exactly fresh, but they will answer for purposes of comparison. A measure of the tendency toward municipal ownership of water works is given in the fact that the tables in the former book show that there are under municipal ownership 95 per cent of the sewer systems, 52 per cent of the water, 13 per cent of the electric light and 2 per cent of the gas plants.

Some data regarding the financial success of municipal and private plants will be found in a volume published in 1899, giving data regarding water, gas and electric light plants, collected and compiled by a bureau now included under the U. S. Department of Commerce and Labor. The names of the cities are not given in the tables.

The following articles pertinent to the question will be found in MUNICIPAL ENGINEERING:

"Water Rates in Illinois Cities," vol. xxxii, p. 20, gives some discussion of the subject and data showing that water rates are in general lower in municipally owned plants.

"Water Rates and Rentals," vol. xxxv, p. 73, gives a discussion of the method of determining water rates, with reference to both municipal and private ownership.

"Water Rates Charged in American Cities," vol. xxxv, p. 12, gives some information about water rates in cities, and averages of annual and meter rates charged in 375 cities, and discusses the reasons for the lower rates in municipal plants.

Other articles are

"Private or Municipal Ownership of Water Works," vol. xxx, p. 366, giving a comparison of rates showing lower rates in municipal plants.

"Municipal Ownership of Franchises," vol. xxix, p. 442.

"Yreka Water Works System," vol. xxix, p. 437.

"Some Varieties of Opinion on Municipal Ownership," vol. xxix, p. 371.

Danville, Va., municipal water works report, vol. xxvii, p. 218.

"Management of Municipal Water Works," vol. xxvii, p. 106.

"Efficiency in Municipal Management," vol. xxv, p. 85.

There is a long list of articles on municipal ownership, in vol. xxvii, p. 274.

The most recent and perhaps the fullest discussion of the subject of municipal ownership, based on close examination of a number of public and private plants for furnishing water, light, etc., will be found in the three volumes of the National Civic Federation's report on "Municipal and Private Operation of Public Utilities." The committee had in its membership too many partisans on each side of the question to make the reports of the various members agree and the final result is not so satisfactory either in character of information presented or in the tone of the discussion as it might be if prepared by less interested advocates.

The new volume of the statistics of cities of more than 30,000 population for 1906 has a table showing the present standing of municipal water departments in those cities, from which some judgment of the success met with can be formed.

Prices for Water and Light.

We desire information as to prices other cities of like size are charging for water and electric lights both for private

and public consumption and will be greatly obliged if you will submit a form of blank which we could send to them and which would cover the matter in question.
B., St. Johns, Mich.

Regarding water rates the fullest source of information is the "Manual of American Water Works" ($4). It gives the following items: City and State; population; fixture rates, family, water closet, bath tub, washbowl, horse and carriage, hose; meter rates for 1,000 gallons, minimum charge per year, maximum and minimum rates, quantity at maximum price and at minimum price and period in which the quantity is used. These are the most common rates in use. There are of course many more and the only way to make any sort of comparison is to ask for a copy of the whole list of rates. Whether St. Johns should pay the same rates is a question which must be answered by a study of the actual cost of supplying water, including all capital charges and depreciation as well as maintenance, operation and repairs. Reference should be made to the article in this department under the heading "Municipal Ownership of Water Works." Several of the articles there listed are upon the subject of water rates and rentals and are directly applicable to this case as well in the arguments presented as in the information given. Note in particular the article on "Water Rates and Rentals" in vol. xxxv, p. 73.

A list of articles in MUNICIPAL ENGINEERING on water and electric light rates will be found in vol. xxxiv, p. 299, and several of these articles give the rates charged, particularly in lighting plants. Other classified lists of articles on the cost of and rates charged for electric light will be found in vol. xxix, p. 96, and vol. xxvii, p. 200, making this magazine the fullest source of such information obtainable.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Selection of Sand for Concrete.

To the Editor of MUNICIPAL ENGINEERING.

Sir—In your Question Department, p. 312, November issue, you analyze some samples of sand sent to you and remark as follows:

"When it is remembered that the standard sand for testing cement is that passing through a 20 sieve and remaining on a 30, it will be seen that less than one-fourth of this sand (sample referred to) is of standard size."

I think that your remarks would leave a wrong impression on the mind of the party asking for the analysis of this sand. It infers that the standard sand is the best sand, whereas it is probably about as poor as can be obtained for practical purposes, as it is composed of particles all of which are the same size.

In the manufacture of concrete the object to be kept constantly in view is density. Maximum density means maximum strength. Density is only obtained through the proper graduation in size of grains from coarse to fine.

The tests for coarseness of sand should be as rigidly enforced as the standard tests for cement. Sand all of which passes the 20-mesh sieve is fine sand. I would prefer a sand analyzing so that 80 per cent would be collected on the 20-mesh, and all passing through a No. 8 mesh. The writer feels that the bad results in concrete work are in a number of cases due to the bad sand used. Therefore this subject is of great importance to the concrete industry.

I am sending you under separate cover a pamphlet on the "Selection and Proportion of Aggregates for Concrete," which I think you will find of interest. Following are the paragraphs in that pamphlet on the selection of sand:

The value of sand for concrete mortar depends largely on its coarseness, graduation in size of grains, and cleanliness. Fine sand contains more voids, more surfaces to coat, and requires more cement and water than coarse sand.

The sharpness of the grains of sand has little to do with its value. It has commonly been supposed that sand should be sharp. This, however, is one of the

theories which has been exploded. The writer has never seen any tangible reason for such theory. In fact, there are many arguments in favor of coarse, round-grain sand. Compactness is what is desired, giving density to the mortar; round grains compact more readily than sharp grains, and the cement will cling to the surface of round grains as well as sharp grains, the character of the surface being identical. Sharp sand is only of value as indicating a silicious sand.

Good sand cannot be easily defined, or an inflexible specification written, as sands of various properties may make equally good concrete. All things being equal, a coarse sand containing a large percentage of coarse particles is far superior to a fine sand in which few coarse particles are present. Sand test for coarseness should be as rigidly enforced as the cement test. The full strength of any cement cannot be developed with a sand, all the particles of which are fine, or so fine as to pass through a 16 or 20 mesh sieve.

The best sand is that which, when mixed with cement and water in the required proportions by weight, produces the least volume of mortar. Economy can be practiced in the matter of the selection of sand. It will nearly always pay the concrete constructor to haul sand even from a considerable distance, paying a higher price, provided he cannot get a sand in the immediate locality of the work, which sand is so graduated in size of grains as to give the greatest density.

As a means of determining the best sand for use in any given mortar, it will be well to experiment as to a mixture of two or more sands which will give the desired results. Cement should be mixed with the sand so as to provide conditions similar to actual work for the reason that cement acts as a lubricant, allowing greater compactness than could be obtained with sand alone. The following method will be found far more accurate than that of void determination, and is practical as it more nearly approximates the conditions surrounding the use of such sand in actual work.

Provide two or more glass graduates, each containing from 200 to 250 c. c. (cubic centimeters), the glass graduates to be about 1½ to 2 inches in diameter. Select several samples of sand, one a coarse sand, another a medium sand and another a fine sand. Wet each of the samples of sand so that the consistency when squeezed in the hand will cause the sand to hold its form without there being any appreciable excess of water, so that each sample of sand while containing necessarily various percentages of water, will be about the same consistency. Take 70 c. c. of the coarse sand and mix 30 c. c. of the fine sand. Weigh 1.609 ounces, or 1 oz. 266.8 grs. of cement. This will give you approximately a mixture of one part cement to three parts sand. Mix the cement with the sand, add sufficient water to bring the sample to the consistency as is usually used by brick or stone masons, and note carefully if the mortar works smooth and is reasonably free from air bubbles. Place this in the graduated glass, little by little, tamp slightly, a little at a time. After your entire sample has been placed in the glass, note the volume as is read on the scale.

Mix the second sample, using 50 c. c. of the coarse sand, 30 c. c. of the medium sand, and 20 c. c. of the fine sand, add same quantity of cement as before, mix with water as before, place in graduated glass and note the volume. Make several samples, using different proportions of the different size grains of sands, always using the same total quantity of sand (100 c. c.) and cement (1.609 oz.) in the mixed mortar; the sand which produces the least volume of mortar will be the best to use. The proportion of cement to be added to this selected sand to give the best results required by the character of work to be done will be described later.

To determine cleanliness, take a sample of sand, pour some clean water in a glass, pour a little sand in at a time. If the water becomes muddy, the sand may contain loam, peaty matter and decayed particles. It is also well to ascertain whether the murky condition of the water is caused by the presence of clay. If so, the sand should not be rejected, provided the clay is not in excess of 15 per cent of the volume of the sand, it having been shown by numerous tests that clay is not a detriment when in small proportions. Ground, well-burned terra cotta or brick, all of which will pass a quarter-inch mesh sieve, may be used with sand or screenings without appreciably reducing the strength of the mortar.

ALBERT MOYER, Assoc. Am. Soc. C. E.,
New York City.

Effect of Salt and Alkali on Concrete.

The Editor of MUNICIPAL ENGINEERING:

Sir—Following up the discussion on the effect of alkalies on Portland cement, which has gone the round of cement and clay journals for some time past, there is a question I would like to ask in MUNICIPAL ENGINEERING pertaining to the subject.

As you know, it is a common practice among cement workers, particularly among sidewalk contractors, to use salt in the mixing of concrete in freezing weather. It appears from information which I have been able to obtain, as well as from experiments made personally, that there is really no objection to this practice, and that in fact salt gives an increased tensile strength to the mixture.

Now, it occurred to me, from studying the reports of investigations conducted in the West in regard to the disintegration of sewers, which had been built in alkali bearing soil some seven to eight years ago, and which when built showed no defects of any kind but appeared to be

perfectly sound, that this disintegration coincides with the phenomenon exhibited from the effect of salt sprinkled on an old cement sidewalk. You have probably seen the effect of salt, where people thoughtlessly sprinkled their sidewalks to remove the ice, leaving the concrete slab in a pitted condition, resembling the scars from smallpox.

The question I want to put to the learned ceemnt specialists is this, if salt has this effect on old concrete sidewalks, why would it not have the same effect on an old concrete sewer? P., ———, Ill.

Concreting in Freezing Weather.

Special precautions must be taken in placing concrete in cold or freezing weather. Concrete in the cold and damp autumn and winter months sets much more slowly than during the summer. For this reason, the centering under the concrete work must be left in place a correspondingly longer time.

Below a temperature of 50 degrees F. concrete sets slowly, and below 40 degrees is very inactive.

At 32 degrees concrete freezes before setting. Remove any concrete known to have been frozen. A slight frost extending only one-fourth inch into the concrete is not detrimental to strength. Some builders claim that concrete can be frozen, thawed out, and will then reset. This may be so in many cases, but it is always best to remove any concrete in which the freezing has extended throughout the mass.

Concrete work can be carried on when the temperature is as low as 20 degrees (never lower) if the following precautions are taken.

1. Heating Grates: Encase the building with canvas and place heating grates or salamanders under the floor being concreted. Keep the building at a uniform temperature of about 60 degrees. Do not allow intense heat to come in contact with the concrete, as it will dry out the concrete before it has set.

2. Covering the Concrete: Cover the concrete after being laid with some good insulating material, such as sawdust, straw, cement bags, manure, etc. Be sure to cover the concrete work before stopping work at night, even though it is warm during the day time.

3. Salt and Calcium Chloride: Salt dissolved in the water used in mixing concrete helps to prevent freezing by lowering the freezing point. A 5 per cent solution (by weight) of common salt is ordinarily used and is not detrimental to strength when so used. Calcium chloride has an advantage over salt in that it reduces the freezing to a lower point. Dissolve in the water needed to properly mix the concrete two pounds of calcium chloride for each bag of cement used.

4. Heating the cement, sand, stone, and water used in the concrete is helpful, but the materials must never be heated to a temperature of over 100 degrees, as the strength of the concrete will be weakened.

5. Removing Falsework: Be sure that the concrete is thoroughly set (not frozen) before any centering is taken down. Leaving all the upright supports in place, remove the sides of the columns and beam boxes and thoroughly examine the concrete. Then remove the slab centering, and lastly the main supports. Leave the centering in place a few days longer rather than take chances. Do not take down the centering too soon.

TRUSSED CONCRETE STEEL CO.,
Detroit, Mich.

Asphaltic Country Roads.

At the good roads congress Mr. George C. Diehl, county engineer, of Buffalo, N. Y., said that asphalt in some form will be the future State road material of the country. Mr. Diehl declared that asphalt mixed well with stone and other materials made a durable and elastic road.

Mr. T. Hugh Boorman, speaking extemporaneously, said in part: Good roads meant in these days of the automobile dustless roads, and that at the forthcoming International Congress on Good Roads to be held in Paris, the vital question in the convention would be the most approved method of surfacing the roads of the world. To his mind there was no uncertainty as to the fact that asphalt in some of its various forms would be the matrix of surface mixtures, the top of the road must be waterproof, in other words dustless, and that object could alone be obtained by the use of asphalt. He said that for over thirty years he had made the subject of good city streets his study and that during the administration of the late General Newton, formerly chief of the Engineer Corps of the United States Army, he had been called on to act as special inspector of asphalt pavements, subsequently acting as general inspector of pavements in the city of New York and so supervised under the direction of the late D. Lowber Smith, the various street pavements then in vogue. These naturally included the Telford macadam pavements which at that time (1886, 1887), proved the best pavement for the boulevards in the upper part of the city. Today these pavements with an adequate surfacing of two to three inches of asphalt concrete would afford durable resilient waterproof and dustless roadways. As he was not speaking in the interest of any company or asphalt industry, he called attention to the fact that municipal officials could purchase the materials and apply the same themselves. He said that the methods of utilizing asphalt with other materials in the most satisfactory manner could not yet be considered as definitely settled and that it was engrossing the attention of many able men. Mr. George C. Clausen of the Sicilian Asphalt Paving

Company, two years ago had laid experimental strips in Bronx Park, New York, and this year was supervising a large stretch of roadway in that park, using the "Sicilian Asphalto," and guaranteeing same for five years. He called the attention of the convention to the fact that many of the delegates would within a few days be going over the race course laid out by the automobile clubs for the race to be held on the 225th anniversary of the founding of their neighboring "City of Brotherly Love" and that they would pass over a section of road treated with "Asphalithic" surface, laid at the intersection of Belmont avenue and the city line by the Filbert Paving and Construction Company of Philadelphia. He said that he had on the previous day called on Mr. J. L. Rake, the general agent of the Barber Asphalt Paving Company, who had informed him that his company was deeply interested in the subject of dustless roads, and had laid asphalt concrete in a number of cities and towns; their expert, Dr. Richardson, had just sailed for Paris to attend the International Congress and so could not be present at this convention. The speaker said that he himself had a number of experimental pavements under way and that in view of the remarks of Mr. Beemer, the deputy State highway commissioner of Pennsylvania, on the scarcity of broken stone in his State, he would add that he had arranged for an experimental pavement to be laid with asphalt and slag. He said that contrary to the conditions of affairs in the past, certainly this country was not now dependent on sources of supply from Europe, the West Indies or South America, and that the United States could now produce all the bitumens necessary for the boundless calls the future would necessitate for furnishing asphalt concrete. He said that a great many of our States could furnish liquid maltha or asphalt which could be refined to any consistency required, enumerating California, Texas, Indiana, Kansas, Kentucky, Ohio, Pennsylvania and possibly New York. He claimed that any oil with an asphaltic and petrolene base could be refined to yield a satisfactory paving material, but that paraffine base oils must be studiously avoided.

In the discussion that followed the delivery of the address, Mr. Beemer said that Pennsylvania could not produce a petrolene base oil, and the speaker on investigation agreed with him as to Pennsylvania and New York. A delegate objected that Mr. Boorman had not dwelt upon the subject of the necessary foundation, and the latter replied that he was addressing himself principally to engineers and public officials who realized fully that a solid foundation was the prerequisite for every well-paved street or road. In reply to the question of cost of the asphalt concrete 2-inch surface, the speaker stated that it would mean an additional expense of not over 20 cents per square yard above the cost of an ordinarily constructed macadam road.

Resistance of Concrete to Fire.

A recent fire at Pembroke, Canada, destroyed a large part of the business portion of the town. The clean sweep made by the flames is seen in the accompanying photograph. The building standing on the right is the carriage factory of Alexander Barr, built of concrete, which is the only one standing in the district covered by the fire. With reference to it Mr. Barr says in the Ottawa *Citizen*:

I was both surprised and delighted with the way my building stood the flames. The test was a particularly severe one, too. The adjoining buildings—as will be plainly seen in the illustration—were entirely swept away. They were

CONCRETE BUILDING STANDS FIRE IN PEMBROKE, CAN.

located within 18 inches of the walls of my building, which remains standing. In addition to the severe heat of the burning buildings there was that of five cords of wood which were piled against the carriage factory wall. The cordwood was entirely consumed, but the wall was unharmed. No water was used to stop the progress of the flames at this point, and in fact no water was used by the city department on the building shown in the photo. I was an eye witness of the fire from beginning to end and I believe that my building would have been entirely swept away had it been erected with other materials. I put up the building in 1905, using International Portland cement throughout. It is 102 feet long and 40 feet wide. By erecting it with Portland cement you will agree I have saved thousands of dollars and a great deal of time and trouble besides. I had no insurance on this building and the results show that I did not need it.

Pavements Damaged by Automobile Tire-Chains, Etc.—Legislation Required.

The Editor of MUNICIPAL ENGINEERING:

Sir—The International Road Congress decided that roads and pavements must be made more durable and be more constantly repaired because of automobiles. On the other hand, automobiles must meet reasonable requirements in regard to their construction, equipment, manner of use and speed, to lessen their damage to roads and pavements. Injury to road surfaces increases with the speed, as demonstrated by tests of the U. S. Office of Public Roads and others in America and Europe. Damage is caused by wheels following in ruts and can be avoided by traveling over the unused parts of roadways. Turning suddenly does damage, while steering by gradual deviation saves the road. The center of gravity of moving automobiles should be required to be midway between the four wheels, to avoid concentration of load on any one or two wheels. The diameter of wheels with the weight of gross load per inch of width of tire should be regulated to save roadways from destructive pressure and excessive semi-vacuum suction.

Long experience in construction and repairs of pavements in many cities has convinced me that the greatest single cause of damage from vehicles to pavements is done by chains and many non-slipping attachments to automobile wheels. The destruction is certain and rapid on composition pavements such as macadam, asphalt, bitulithic, etc., where chained, armored or equivalent tires are constantly used. Such appliances reduce the points of contact with the pavement, so that excessive weight is concentrated immediately under the chains, etc. Automobiles often run at fifteen, twenty-five miles and greater speeds per hour. The lowest speed mentioned is 1,320 feet per minute. Chains and armored devices at 3-inch spaces on a tire (they are generally closer), traveling at the low speed mentioned, give sharp impacts and thrusts at the rate of 439 per minute per wheel, crushing, loosening and displacing pieces of pavements.

Mr. McKenzie, a well-known automobile authority in England, stated that "road engineers are unanimously of the opinion that while high-speed motor traffic causes considerable damage, armored tires cause rapid destruction." He exhibited pictures and figures showing the damaging effect of armored tires upon asphalt surfaces in London. The same excessive injury to pavements can be observed on boulevards, avenues and in parks in New York, Chicago and many of our cities.

Automobilists often put chains and armored devices on their cars, early in the winter, and retain them in use, without respect to weather, until spring. Some of the devices are objectionable at all times, while others have only an excuse for use when road surfaces or pavements are slippery from ice or snow. Macadam and most composition pavements present small angular pieces of stone and sand firmly held in place, and thereby eliminate the need of any rough and damaging devices on wheels.

The remedy of this evil practice of a small minority of automobile users, lies in the making of laws, ordinances and rules by States, counties, cities and park boards, prohibiting or restricting the use of non-slipping devices. Massachusetts (Revised Laws Park Com., Chap. 28, Sec. 30), is a late example, forbidding the use of "an automobile or motor vehicle which has about or affixed to any wheel or tire of any wheel thereof a chain or rope of metal or other material."

Legislation on this subject is required in many places and should be done before winter begins, so as to save extra expense of pavement repairs next spring. Where, for local or other reason, a legislative body does not wish such excellent and stringent requirements as the one above quoted, it will be wise to provide substantially as follows:

First—Prohibiting automobiles with wheels or tires armored by chains or other non-slipping devices, to be used on public streets or highways at all times, except when the surface of said streets or highways are covered with ice, or with snow at least one-half inch in thickness.

Second—Prohibiting automobiles, when said devices are applied to their wheels and when the surface of public streets or highways is covered with ice, or with snow less than one-half inch in thickness, from traveling at a speed greater than six miles per hour.

Third—Prohibiting the use, on the wheels or tires of automobiles, of chains, armored, non-slipping, non-skidding or equivalent devices which have links, bars,

lugs or other projections extending more than one-fourth inch beyond the surface of the tires or uniform covering of the tires of any or all wheels, and which chains or other devices are less than one-half inch in width or diameter at any place or surface of contact with a pavement or road surface.

Such legislation will mitigate if not wholly remove this unwarranted cause of injury to pavements and enable them to be kept in constant, better condition for the benefit of all, including automobilists themselves.

J. W. HOWARD,
Consulting Engineer on Pavements,
New York City.

A Concrete Pavement in Bozeman, Mont.

The Editor of MUNICIPAL ENGINEERING:

Sir—I have been a subscriber to MUNICIPAL ENGINEERING for several years and have derived a great deal of help and benefit therefrom. I thought you might be interested in the following report which I have made on the concrete pavement constructed here this season and an editorial regarding same in the Bozeman *Chronicle*.

The report is as follows:

The paving of Main street from Central avenue to Wallace avenue, in Special Improvement District No. 21, with concrete, has been completed in accordance with the plans and specifications, except that the north half of the block from Church avenue to Rouse avenue is not old enough to open for travel.

The cost of the portion to be paid by Special Improvement District No. 21 is as follows:

Printing resolution and ordinance, $69; printing bonds, $55; Hartman & Hartman, legal services, $50; 19,514.37 square yards paving at $1.95, $38,053.02; 5,146.5 cubic yards excavation at 50 cents, $2,573.25; 300 feet of overhaul at 3 cents on 820 cubic yards, $24.60; 1,489 cubic yards gravel fill at $1.25, $1,861.25; advertising for bids, portion for district, $64.63; engineering portion for district, $823.96; inspection portion for district, $274.57; 6 per cent interest on bonds and other items to January 12, 1909, $649.77; total cost to district, $44,499.05.

The estimated cost which I prepared for the resolution was $46,523.50, making the cost of construction to the district $2,024.45 less than the estimated cost. The cost per square yard of pavement, including excavation and gravel fill, was $2.13, while the total cost, covering all items, was $2.28, the estimate having been $2.40 per square yard.

The cost per front foot to abutting property was $7.46, while the estimated cost was $7.82. The assessment list has been prepared, which divides the cost into ten payments.

I desire to say that the contract has been executed by S. Birch & Sons Construction Co. in a manner which has been highly satisfactory, and I am more than pleased with the pavement.

The test which it had when the south half was opened for travel was more severe than it will ever have again, as all the travel was confined to one track and a great many heavy loads of gravel were hauled over the pavement while it was yet green, and little or no signs of wear can be seen while the strength of the pavement will increase for several months.

The cost to the city for 4,248.72 square yards of pavement at street intersections was $9,511.98. The cost to the Bozeman Street Railway Co. for 2,018.4 square yards of paving along their tracks and 1 foot each side was $4,314.35. Total pavement laid, 25,781.49 square yards; total cost, $58,325.38.

The editorial referred to is as follows:

The report of the city engineer on the paving of Main street, which appears in another part of this paper, shows that the work has been completed in a most satisfactory manner and at a considerable less cost than had been estimated.

The improvement in the appearance of the street is certainly very great and when the time comes when the street can be kept clean by means of a rotary sweeper or some other method, the paving will be a great advertisement for the city.

However, the paving is still green and not near as durable as it will be when it hardens for a few months more, and it might not be a bad idea to permit the earth which vehicles bring onto the paving from other streets to remain on it for a time, as it would thereby be protected more or less from wear and tear till it had gained its permanent strength.

Time alone will tell of the durable qualities of the paving, but this is the only question which can be raised in regard to it, as in all other respects it makes an ideal roadway for a business street and from an engineering standpoint. It would be hard to improve on the grades established for drainage purposes and the street approaches.

The paving of Main street should be only an incentive to inaugurate further improvements along the same line. No city in the State is growing faster than Bozeman, and the civic improvements should keep pace with that growth.

C. M. THORPE, City Engineer,
Bozeman, Mont.

How to Set Protected Curves at Curb Corners and Lay Gutters.

Setting Curves. The same procedure is followed as in setting straight curb, excepting the substitution of thin, bending boards, for the plank with which to set the frames; for less than 7-foot radius one-fourth inch to three-eighths inch is the proper thickness for the boards, for larger radius one-half inch may be used.

Cypress is the best for this work, dressed one side, and basswood is second best; no other wood will be found as satisfactory.

Do not try to set the boards to a true circle, but lay the curved corner-bar in proper position and set the boards to the bar, first being sure the bar is reasonably true. It is better not to try to set a corner until after one of the tangent curbs is set, which gives one solid end to work from.

If there are many corners to set it pays to get a piece of sheet steel one-eighth inch thick, about 14 inches wide and 10 feet long, or less, according to the work usually required; use this on outside of curb and a rigid form on inside. By this plan the corner frames can be set very quickly and accurately. Oil the steel when not in use, and it will last for years.

The exact location of any curve, or in other words, the point at which the curve should stop and the tangent begin, can be accurately located by setting two lines even with the face and parallel to the two tangent curbs, carrying the lines out into the intersection of the street, as shown in cut, until they cross each other.

In case of a 90-degree or right angle curve, the ends of the curve should be the same distance from the intersection of the tangent lines as the radius of the curve. For example, the junction of a 6-foot radius 90-degree curve with either tangent, should be 6 feet from the intersection of the tangent lines, as shown in cut No. 3.

To find the length in feet and inches of any curved curb, multiply the given radius by 6.283, which will give the circumference in feet of the complete circle; then divide result by 360, which is the number of degrees in any complete circle; the result will give you the feet or fractions of a foot in each degree. Next multiply this result by the number of degrees of the intersection angle required, as given by the engineer, and you will have the length of the curve in feet and tenths. See example for 6-foot radius: 6.283 multiplied by 6 equals 37.698, divided by 360 equals .01047, multiplied by 90 equals 9.423 feet, length of intersecting curve.

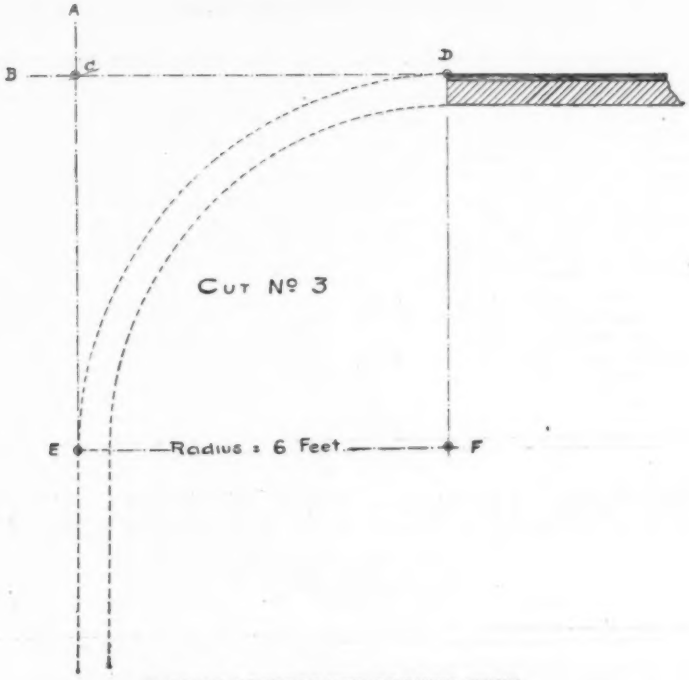
In the case of acute or obtuse angle curves, it is customary for the engineer to give the number of degrees of the intersection curve (which will be either more or less than 90 degrees) as well as the radius; with these data given the length of the curve can be ascertained by the same rule as above.

The rule for finding the point of junction or tangent point of an acute or obtuse angle curve: Multiply the natural tangent of one-half the intersection angle by the radius required, which will give you the distance of the tangent point from the point of intersection of the two tangents.

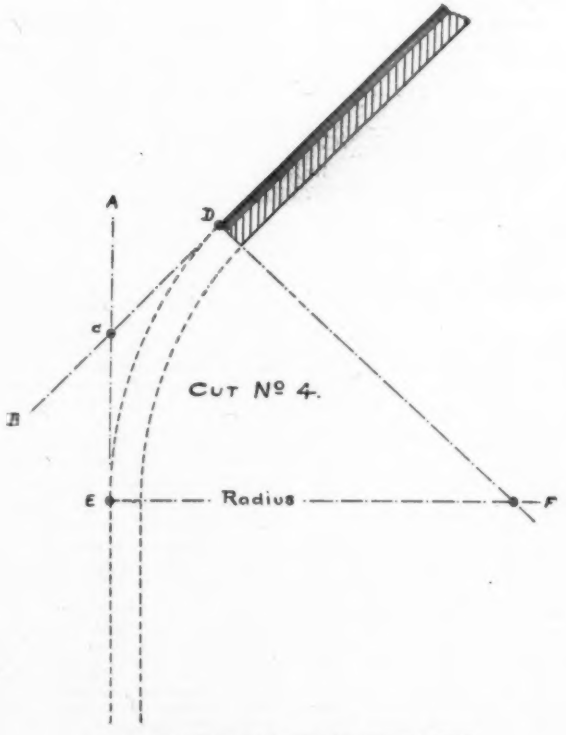
If the radius is 6 feet and the angle of the curbs is 40 degrees, the natural tangent, 0.364 multiplied by 6 equals 2.18 feet, the distance C D or C E in cut No. 4, measured in extension of the straight curbs.

When laying gutters with steel-bound curb, it is preferable to lay the curb first, the same as though the gutter was not included, then as soon as the frames are removed from the curb and the face is finished down to the point where the gutter is to join, lay the gutter at once, while the curb concrete is green, so there will be a semi-bond between the gutter and the curb, which is all that is desirable. The gutter should be slightly grooved with a special tool at the point of junction with the curb, and should also be jointed every 4 to 6 feet of its length, depending on its width. The narrower the gutter the nearer should be the joints, which should be cut the same as sidewalk joints and carefully finished with a jointer. The outer edge, when not protected with steel, should be well and carefully rounded with a special tool of one-half inch radius for macadam, gravel or rough stone streets, and one-quarter inch radius for any other kind of paving such as asphalt, brick or cut stone. The thickness of the gutter should run from 5 to 8 inches, depending on its width, and should always be laid on the natural ground, well rammed, unless of a wet, clayey nature, then it should be underdrained.

The gutter concrete should be made the same as curb concrete, likewise the top or finish coat, which should be 1 inch thick and laid on immediately after the concrete is rammed, care being taken that the concrete has no surplus water on top at the time of placing the finish coat in position. The concrete should be cut about three-quarter way through before the top is put on and the joint made with sand the same as described for the curb, care being taken that but a small amount of sand be used, and that the concrete be well rammed afterwards. At the time the concrete is cut, mark the curb and side strip so you will know the exact point to make the top joint. There should be absolutely no variation between these two cuts, and the sand joint should never be more than one-quarter inch wide at the widest point; one-eighth inch is preferable. Gutter laid in this way can be moved or relaid like natural stone, but the semi-bond retains it in position for all ordinary strain. The most desirable pitch for gutter (from pavement to curb) is one-half inch to the foot. When gutter is laid for macadam, where heavy rolling might lift the work, it is well to set plank about 2 inch by 9 inch on edge, about 3 inches below the top of gutter. The plank should be set before the work is laid, and with about 10-degree batter, then thoroughly ram the earth before laying the concrete. A 2-inch by 3-inch



LAYING REINFORCED CORNER CURB.



LAYING REINFORCED CORNER CURB.

strip, set on top of edge of plank, will complete the form in which to lay the concrete, the strip to be removed after work is finished. Instead of the plank it is sometimes desirable to extend a protest of rough concrete down from the gutter about 12 or 14 inches from top of same, which will prevent the trouble above referred to.

Keep Good Roads in Repair.

While American roads as a whole are notoriously the worst in the world, we are well up on road building in this country, according to Logan Waller Page, chief of the Office of Public Roads of the Department of Agriculture, who has returned from the International Conference on Good Roads at Paris. He says we have some of the best methods, compared with those abroad, and can build good roads and build them cheaply, but the trouble is that we build a road and let it alone and do not pay the attention to keeping it up that is paid abroad.

At the road conference twenty-nine nations were represented. America was the foremost in proposing the monument now projected to the great French highway engineer Tresauget, who antedated Telford and Macadam by forty years and who really designed the broken stone road now known as the Telford road.

MUNICIPAL MATTERS IN COURT

Vested Right in Bridge—Filtration Patents—Reasonable Water Rates

Railroad Company Has No Vested Right in Bridge.

A decision was handed down by Justice Brown, October 21, at Buffalo, N. Y., allowing the Lackawanna Railroad Company to replace its lower fixed bridge across Buffalo river by a new fixed bridge. The decision is made with the understanding, however, that the new structure is to be temporary, existing only until such time as the work of improving the river shall have reached the bridge, when it must be replaced by a swing or draw bridge which will not interfere with navigation of the river by lake craft.

The city asked for an injunction restraining the company from building a fixed bridge. In a measure the decision is regarded as a victory for both sides. The injunction desired by the city is granted, but its operation is suspended for a period of eighteen months, when, if the improvement work shall not have reached the point where the bridge crosses, an application may be made to the court for a further extension of time.

The railroad company claimed that the section of the charter requiring new bridges to be of the swing or draw variety was unconstitutional. Regarding this Justice Brown says:

The claim that this section of the charter is unconstitutional because it deprives the defendants of a valuable property right without due process of law is founded upon the fallacy that the defendants, under their franchise, have a vested right to forever keep and maintain a fixed bridge at the point in question; that the Legislature, in 1884, having declared that the fixed bridge then existing was a lawful structure, all fixed bridges thereafter built at that river crossing must likewise be lawful structures.

It may be true that the defendants have a vested right to keep and maintain the bridge of 1884 as a fixed bridge as long as they care to, and any interference with that right by the Legislature might be prohibited by the constitution, but the defendants are going to, in fact, abandon the bridge of 1884, and the bridge referred to by the Legislature, in fact, goes out of existence. The defendants' franchise right to cross the river is not interfered with in the slightest degree; simply the manner of crossing is regulated, and then only when the defendants completely remove all of the structure that has been declared to be lawful; and the manner of crossing is regulated only to the extent of saying that the defendants must so cross as not to interfere with navigation.

Justice Brown sustains the city's contention that the new bridge the company proposed to build will be, in fact, a new bridge and not a repaired bridge. His opinion on this question is as follows:

The present bridge of the defendants, while it existed in 1884, at the time the statute was passed declaring it a lawful structure, will no longer exist when the defendants have done the things they proved on the trial they were going to do. The proof is that the foundations, the abutments and pier are in a greatly damaged condition, cracks existing perpendicularly through courses of stone, necessitating rebuilding; that the defendants intend removing the entire superstructure and several courses of stone, making a larger, higher, heavier and more substan-

tial structure, utilizing a few courses of stone of the present abutments and pier, practically making a new foundation and placing thereon an entirely new girder bridge of modern type. If this is not a new bridge and a new foundation, it is difficult to define one. If it is not a "bridge hereafter built," in the language of the statute, the use of one single foundation stone of the old substructure would defeat the right of the city to compel a swing or draw bridge to be erected at any time in the future.

Justice Brown furthers says that to allow the erection of a new permanent fixed bridge would be to permit the railroad company to exclude the public from the river for navigation purposes. In conclusion he holds that the present bridge must be replaced, as it has been condemned as unsafe; that the defendants have material for a new girder bridge that can be assembled and put on new foundations in a comparatively short time, and that such temporary use of the material on hand will not interfere with its future use in some other structure.

Judgment, with costs, was entered in favor of the city. The railroad company will appeal from the decision.

Litigation Over Patents on Negative Head Apparatus in Water Filtration Plants.

The New York Continental-Jewell Filtration Co. has brought suit against the city of Harrisburg, Pa., for alleged infringement of patents No. 546,738, reissue No. 11,672, and No. 644,137. The patents in suit relate to the method of and the apparatus for using a down-draft outlet pipe and are generally spoken of as the "negative head" patents. The city of Harrisburg has instructed its Board of Public Works to defend these suits, and the city solicitor, the Hon. D. S. Seitz, has secured the co-operation of ex-Judge M. W. Jacobs, patent attorney, and Mr. James H. Fuertes, of New York, consulting engineer to the Board of Public Works, Harrisburg.

As the filters at Louisville, Ky., Columbus, O., New Orleans, La., and those of the Hackensack Water Co. at New Milford, N. J., are built in a manner similar to those at Harrisburg, the cities and companies owning the four filter plants resembling the one at Harrisburg have decided to co-operate in making a defense in this suit.

On November 6, 1908, a conference was held at Columbus, O., of representatives of the above mentioned cities and water companies and there was appointed a joint committee to conduct the affairs of the associated cities and companies in co-operating with Harrisburg in making this defense. This committee consists of Geo. W. Fuller, consulting engineer, 170 Broadway, New York City, chairman; Theo. A. Leisen, chief engineer and superintendent Louisville Water Co., 549 Third street, Louisville, Ky., treasurer, and Geo. W. Rightmire, patent attorney and president of City Council, 44 East Broad street, Columbus, O.

The joint committee has secured the services of Mr. Allen Hazen, consulting engineer, New York City, and Prof. J. W. Langley, patent expert, Ann Arbor, Mich. Ample funds have been placed at the disposal of the joint committee with the stipulation that the suit shall not be compromised and that if the suit is pressed it shall be prosecuted to a final judgment.

Water Rates Fixed by Ordinances Must Be Reasonable.

The Lake Forest Water Company asked the court to declare void an ordinance passed January 9, 1905, by the city of Lake Forest, Ill., fixing rates for water for public and private consumption. Hydrant rentals began at $40 a hydrant when the company began business and have been changed from time to time until they became $40 for 500 feet of mains in use. Meter rates were fixed in 1904 at 25 cents a thousand gallons with a minimum charge of $9 a year per consumer. The company has paid but four dividends of five per cent each since 1891. Its capital stock paid up was $49,750 at the beginning and the plant was valued in 1902 at $113,188. The ordinance complained of was based on a valuation of $104,610 made by D. H. Jackson, not including "going value," and fixed $40 per 500 feet for city purposes, meter rentals of $1.48 for 1-inch meter, $3.40 for 2-inch meter and 20 cents a thousand gallons for private consumers.

Suit was brought in October, 1905. Four acknowledged experts, two on each side of the case, varied in their estimates of the value of the plant, made on practically the same statement of facts, from $130,000 to $90,866.17, and in the estimate of a fair return on the investment from $24,000 to $15,645. The "going value" was estimated at from $26,000 to $2,600. The judge took the former appraisals of 1902 and 1904, added to them items not included and took the actual cost with addition of a sum representing the increase in prices since the time of construction. Offsetting depreciation by "going value," this and the two corrected appraisals all fell between $117,000 and $124,000 and the judge assumed $120,000 as the appraised value, without reference to the testimony of the experts. He fixed the rate of interest on this value at 6 per cent, which would be about 12 per cent on the capital stock outstanding.

The variations in income and expense from year to year apparently confused the judge and he took the averages for five years and corrected them rather arbitrarily, and thus arrived at a net income of $8,500 a year at the date of the ordinance complained of. There being a variation in the experts' evidence on the effect of the reduction in rates as great as that shown in their testimony on values

and required returns, he assumed $1,000, thus making the probable net return of operations $7,500 a year. The annual charges he computes by taking the 6 per cent interest on the value or $7,200 and adding $500 for salary of manager, not heretofore charged, and $2,000 for sinking fund to make up the difference between the present value of the plant and the estimated value at the end of the franchise, $60,000 at the end of 15½ years. These charges amount to $9,700, making a deficit under the new rates of $2,200 a year.

The court therefore declares the new rates unreasonable and the ordinance void.

Garbage and Refuse as Fuel in Nottingham, England.

In a recent report, Consul Mahin, at Nottingham, England, discusses the utilization of ashes, kitchen scraps, and house refuse generally, in making electricity for street railways and for lighting purposes as follows:

The total weight of this refuse is about 1,500 tons a week. It is burned in two city refuse destructors. This requires no other fuel except a trifle for starting the fire on Mondays, and enough steam is produced by the destructors to provide electricity for a third of the needs of the tramway system. Some of the electricity is also used for lighting purposes. Only tin cans and the like are separated from the rest and sold. All the rest is destroyed.

The city owns two destructors, costing, respectively, $38,932 and $102,196. The more expensive one is equipped with electric machinery costing $12,166, connected with the tramway lines. The cost of wages and other expenses of the destructors averages about 35 cents a ton of refuse burned. The average quantity of electricity units produced is 44.23 per ton. Though the system of converting refuse into electricity works admirably well here and is a saving to the taxpayers, it is stated that only 40 other towns in the country use anything similar.

Besides electricity the Nottingham corporation produces from the house refuse more street paving stones than it can use. A plant connected with the main destructor mixes the clinkers with cement and places the composition under hydraulic pressure. The product is said to be even harder than stone and can be used for building purposes as well as street paving. The operation, being new, is still somewhat experimental, but the engineer in charge says the product will wear longer than the paving stones commonly used, while costing the city less than half as much. Another destructor, larger than either of the two now operating, is contemplated by the city authorities.

The sewage of Nottingham is spread upon a farm of 1,894 acres about five miles from the city. The land, having a gravelly subsoil, is well suited to filtration. About 10,000,000 gallons are run upon the farm every twenty-four hours. The annual expense and the income from the farm are substantially the same.

MUNICIPAL AND TECHNICAL LITERATURE

Water Pipe Specifications—Passaic Valley Sewerage Commission—Municipal Reports—New Publications

Standard Specifications for Water Pipe.

The American Water Works Association has printed in a special pamphlet the standard specifications for cast iron water pipe and special castings, adopted May 12, 1908, and has added tables of dimensions, thicknesses and weights.

The various sections give description of pipes, allowable variations in diameter of pipes and sockets in thickness and weight, treatment of defective spigots, special castings, marking, quality of iron and castings and methods of testing, casting, cleaning, inspecting, coating, weighing, etc., and the relations of contractor, engineer and inspector. They can be obtained of the secretary of the association, J. M. Diven, superintendent of water works, Charleston, S. C.

Passaic Valley Sewerage Commission Reports.

The report of the Passaic Valley Sewerage Commission outlines definitely the proposed trunk sewer, the cost of construc-

tion, expense of operation and maintenance, the methods of distributing the burdens among the taxpayers who will be benefited, and gives the details of how the sewage will be treated before it is discharged into the waters of New York Bay. The proposed flume will extend from Paterson to a point in New York Bay near Robbins reef. Rudolph Hering and George W. Fuller, engineers to the commission, place the maximum cost at $12,250,000, including $250,000 needed to secure property rights, and these figures are confirmed by engineers Allen Hazen, William M. Brown and Edlow W. Harrison, who conducted investigations as to this phase of the work independent of each other. The estimated cost of operation and maintenance, at the outset, based on an average daily flow of 120,000,000 gallons, is $170,000 per annum, increasing gradually to $283,000 yearly, when, it is estimated, the full capacity of 360,000,000 gallons per day will have been reached.

The commissioners, in making calculations for the apportionment of the cost of the proposed trunk sewer, caused to be prepared a table showing the total tax valuations in 1907 of the various municipalities affected. These figures, together with certain deductions made for areas outside the drainage district, net valuations and proportionate cost of constructions, are given in the following table:

	Total tax valuations of 1907.
Essex County—	
City of Newark	$295,787,923
City of Orange	22,166,600
City of East Orange	40,188,850
Town of Bloomfield	7,913,749
Borough of Glen Ridge	4,245,000
Town of Montclair	26,915,100
Township of Belleville	5,489,692
Town of Nutley	4,152,803
Totals	$406,859,717
Passaic County—	
City of Paterson	$90,764,011
City of Passaic	26,842,714
Township of Acquackanonk	5,398,250
Totals	$123,004,975
Bergen County—	
Borough of Garfield	$1,888,579
Borough of Wallington	581,699
Borough of East Rutherford	1,483,989
Borough of Rutherford	4,940,831
Township of Union	1,949,734
Borough of North Arlington	320,355
Totals	$11,165,187
Hudson County—	
Town of Kearny	$13,945,150
Town of Harrison	9,823,455
Borough of East Newark	3,219,000
Totals	$26,987,605
Summary—	
County of Essex	$406,859,717
County of Passaic	123,004,975
County of Bergen	11,165,187
County of Hudson	26,987,605
Totals	$568,017,484

Deductions for area outside of district.	Net valuations taxable.	Proportionate cost of construction.
$8,278,940	$287,508,983	$6,361,996.38
.....	22,166,600	390,502.34
.....	40,188,850	889,298.54
.....	7,913,749	175,115.37
.....	4,245,000	93,933.33
.....	26,915,100	595,577.11
.....	4,489,692	121,475.86
.....	4,152,803	91,893.19
$8,278,940	$398,580,777	$8,819,792.12
.....	$90,764,011	$2,008,425.28
.....	26,842,714	593,975.36
.....	5,398,250	119,452.43
.....	$123,004,975	$2,721,853.07
.....	$1,888,579	$41,790.46
.....	581,699	12,871.83
$1,095,800	388,189	8,589.84
3,271,566	1,669,265	36,937.49
947,625	1,002,109	22,174.66
174,943	145,412	3,217.68
$5,489,934	$5,675,253	$125,581.96
$651,150	$13,294,000	$294,169.52
.....	9,823,455	217,373.33
.....	3,219,000	71,230.00
$651,150	$26,336,455	$582,772.85
$8,278,940	$398,580,777	$8,819,792.12
.....	123,004,975	2,721,853.07
5,489,934	5,675,253	125,581.96
651,150	26,336,455	582,772.85
$14,420,024	$553,597,460	$12,250,000.00

A table giving estimated future population in the district is also given, as follows:

Municipality.	Estimated population, 1911.	Estimated population, 1940.	Area, acres.	Population, per acre.
Paterson	119,600	276,420	5,015	54
Manchester	2,900	11,000	935	12
Prosp'ct Park	2,400	9,000	218	41
Hawthorne	3,300	12,000	2,180	5.5
Glen Rock	1,000	7,000	1,866	4
Saddle River	2,200	32,900	7,192	4.5
Midland	350	1,500	512	3
Acquackan'k	10,100	70,860	7,162	10
Passaic	54,300	128,400	1,994	64
Garfield	7,900	30,000	1,360	22
Lodi	4,300	15,000	1,510	10
Hasbr'ck H'ts	1,400	6,400	358	18
Woodridge	300	6,000	475	13
Wallington	3,600	20,000	685	29
Carlstadt	1,800	5,100	237	22
E. Rutherf'rd	1,800	6,460	237	27
Rutherford	2,700	20,040	640	31
Union	1,600	20,000	935	21
N. Arlington	300	10,000	480	21
Nutley	5,900	47,100	2,176	22
Belleville	10,200	51,000	2,006	25
Newark	331,300	512,500	9,475	54
East Orange	30,300	70,980	2,502	28
Bloomfield	14,600	45,000	3,460	13
Glen Ridge	2,900	15,000	825	18
Montclair	19,800	50,000	3,900	13
Orange	28,600	60,000	1,410	43
Harrison	16,000	39,200	692	57
E. Newark	3,300	5,600	70	80
Kearny	17,700	64,980	1,320	49
Totals and aves.	702,400	1,649,440	61,827	27.1

Municipal Reports.

Annual Report of the Board of Public Works of Grand Rapids, Mich., for year ending March 31, 1908. L. W. Anderson, city engineer.

The Grand Rapids board operates the water and electric lighting systems and the public works department. In round numbers the income of the water department was $162,000 and the maintenance and operation cost $55,000, so that over $75,000 was transferred to the sinking fund and the cash on hand was increased some $36,000. The water department is credited with over $11,000 for city uses of water, including fire hydrants, flushing sewers and engine houses. In the expenditures are included $10,000 for extensions and new construction. The present value of the water plant is $1,420,041 after charging off depreciation on a definite plan, abandoned mains and machinery and maintenance and engineering items, amounting to about $483,000. The bonded indebtedness is $1,100,000, on which the interest is $48,000. The sinking fund, after paying this interest, has $61,500 on hand. There is also a water works extension fund which disbursed $80,960, after borrowing $20,000 from the contingent fund and it still owes $23,216 in the shape of debit balance. The standard form of water works statistics is used and rearranges the figures given in the report so as to show the details in form comparable with other years and with other cities.

About a dozen brick streets were constructed, all but one with cement filler and "pioneer" asphalt filler for expansion joints. One block which had to be opened to traffic at once had its joints filled with "pioneer" asphalt. One street was laid with creosoted wood block of the Republic Chemical and Creosoting Company, with Barrett's bituminous cement filler. A small asphalt repair plant on wheels for use on the streets was used for a few weeks at the end of the season. The city owns five road rollers, four of which are in operation. The five cost from $975 to $1,832 for operation and maintenance during the year, a total of $7,386. The various street and sewer improvements were charged $10,200 for work done by the rollers and there were $2,300 receipts from other sources, leaving a handsome balance in the fund toward purchasing a new roller to replace one which is worn out.

New sewers amounting to 4.5 miles were built during the year, making the total mileage of sewers 167.7, as compared with 172.6 miles of water pipe and 294.3 miles of streets.

About $17,000 was expended on underground conduits for wires.

The smoke inspector is a new official making his first report. He has served 56 ordinance violation notices. Of 297 installations at the beginning of his work 265 were ordinary installations, the others having one or another device intended to reduce the production of smoke. At the end of the year the number of ordinary installations had been reduced to 195, the others being increased by the same amount. Smoke charts are given showing the reduction in smoke by various kinds of installations. Thus a plant having 56 per cent of black smoke, and 10, 17, 16, 11 respectively of dark brown, light brown, and faint smoke and clear air, was changed by the installation of an automatic stoker to 0, 0, 1, 3, 96 per cents respectively, or to no smoke for 96 per cent of the time. Another plant ranging from 35 per cent black smoke down through 29, 20, 16 to 0 per cent clear, was changed by the installation of a patent hand-fired furnace to 0 per cent each of black and dark brown smoke, 1 per cent light brown, 10 per cent faint and 89 per cent clear. In a third plant a change to Pocahontas smokeless coal gave results within about 8 per cent as satisfactory.

New Publications.

Water Works Distribution. A practical guide to the laying out of systems of distributing mains for the supply of water to cities and towns. By J. A. McPherson. Cloth, 161 pp., $2.50. D. Van Nostrand Co., New York.

The author is the chief engineer of the water works of Bristol, England, and is fitted by experience and training for the task he has set himself. The present volume is the second edition of a book issued some seven years previously and has a few additions, amounting in all to seven or eight pages, all that were deemed necessary to keep the book up to date. English practice is given in some detail by suggestions of various methods of solving water works problems.

The general arrangement of supply to district of distribution is considered mainly from the point of view of the small plant. Supplies and pressure maintenance by pumping, low service reservoirs, standpipes, elevated tanks or towns, and accumulators are briefly described, also the character of the supply lines, whether aqueducts, pipe lines or combinations, and the limitations and requirements of each.

One chapter is rightly named "Notes Upon System of Distribution," as it is rather scrappy, but so far as it goes, gives evidence of being prepared from actual practice. The chapter on details of method of laying out distributing mains is more thoroughly worked out, with the help of a rather simple example from practice. Apparently reinforcing lines of mains and dead-ends are not such essentials in the author's practice as they are deemed to be by many American engineers, the former being conspicuous by their absence in large part, and the latter by their frequent presence.

Pipes and fittings are detailed, including cast iron and steel pipe, joints and joint materials, valves of all sorts, hydrants, standpipes, nozzles, sprinklers, ap-

paratus for drilling pipes under pressure and connecting and laying service pipes, cocks, taps, plumbers' fittings, etc. Various forms of meters are briefly described and their use in determining waste is detailed, including methods of operating, recording and computing.

The book is interesting and of value for its practical suggestions, but will hardly replace in this country books giving the same subjects more thorough treatment and devoted to American practice, which differs mainly in details of apparatus and materials from the practice therein detailed.

Control of Municipal Public Service Corporations. The number for May, 1908, of the Annals of the American Academy of Political and Social Science. Paper, 201 pp., $1. Published by the Academy, at Philadelphia, Pa.

This number is devoted to public service corporations and has a number of articles by experts in this line. Four are on franchises, public service commissions, public utilities, regulation and transit control in New York city and State; three on various phases of the subject and on municipal ownership movements in Chicago. There are also articles on the public service corporations in Detroit and in New Orleans, the Boston Consolidated Gas Company, Philadelphia's rapid transit corporations, New Jersey restrictive legislation, the finances of the District of Columbia, legislative regulation of electric railways, especially in Kentucky, and some minor communications. The articles are carefully prepared and together cover a large share of the development in this country in the direction of reasonable control of municipal public service corporations. Massachusetts, aside from the Boston gas company, and Wisconsin are not favored with special articles, but aside from this the book is quite satisfactory and will open the way to more thorough study of the question.

The Structural Slide Rule, by John L. Hall, Structural Slide Rule Club, Box 12, Sta. J, New York City.

This is a triangular scale, 15 inches long, and a calculating rule in one. As a scale, it gives ⅛, ¼, ½, ¾ and 1½-inch scales. As a slide rule, it gives on one the regular Manheim slide rule for ordinary multiplications, divisions, squares, cubes, square roots, and cube roots. The reverse side of the scale shows logarithmic sines and tangents with a scale of 500 equal parts down the center.

Another side gives rules for computing steel columns and compression members. The formula used is that of the New York building code, in which the stress per square inch equals 15,200 minus fifty-eight times the length of the column, divided by the radius of gyration of the section. The fixed scales give length of column in feet, and safe load per square inch, and the slide gives the radius of gyration in inches. The reverse of the slide is graduated in inches and sixteenths.

The third side gives scales for the solution of problems relating to the strength of beams carrying uniformly distributed loads. The slide is double in this case. Of the fixed scales, the upper represents the relative strength of steel I-beams from 3 to 24 inches in depth, and steel channels from 3 to 15 inches, standard shapes adopted in 1896 by the Carnegie Steel Company. The lower fixed scale represents the load per square foot of the supported area. It is also used for finding the moments of resistance, or bending moment, and the end reactions. Of the slides, one represents the length of span between supports in feet. The other has two scales, one giving the spacing of the beams, or the width of the supported area, and the other being an auxiliary scale, for use in finding the end reactions. By making some calculations the scales can be used for concentrated loads also. One of these sliding scales is graduated on the back to inches and sixteenths, and the other in part to fiftieths of an inch, and in part to five-hundredths of a foot.

Under each of the slides are skeleton problems, showing how to set and read the scales.

The "Slide Rule Pocket Manual" accompanies the rule and explains both the simple and complicated operations possible with it. It also shows how the rule can be used for other constants than those adopted by the use of other settings, thus adapting it to many problems besides those for which it was directly designed.

The rule should be very convenient for those engaged in structural work, and while much of it is not new, the arrangement is convenient and the rules given show much ingenuity in application.

Reinforced Concrete Design. A graphical handbook. By John Hawkesworth, C. E. Cloth 64 pp. and fifteen double and single page plates. $2.50 net. D. Van Nostrand Company, New York City.

A series of plates showing graphically, by means of plotted curves, the required design for slabs, beams, and columns under various conditions, make up the book, with explanation and examples of the methods of using the plates. There is also a plate, illustrating the complete design of a reinforced concrete structure. An appendix gives the hypothesis on which the formulae used are based, and shows the derivation of these for rectangular beams with reinforcement in tension, T-shaped beams, columns with longitudinal reinforcement, and also hooped as well. The requirements of the New York building code in reinforced concrete design are also included.

The plates in order give curves for determining the constant for determining resisting moments, the design of slabs, under various conditions of span and loading, the spacing of square bars re-

quired to give a given proportionate area of metal, the external bending moment in footing slabs due to the column loads, the resisting moment for beams and slabs of various depths, reduction of proportions of reinforcement to areas and numbers of bars, location of neutral axis, shearing resistance of reinforced concrete combinations, square column dimensions under New York code, rectangular columns with various stresses and round rods required, hooped columns with six and eight longitudinals, and a complete design of a reinforced concrete structure.

The diagrams should be very convenient for those designing under the New York requirements, and many of them can be reduced to other cities' needs by simple arithmetical operations, performed, perhaps, on the slide rule.

Denkschrift ueber die Brandversuche im Wiener Modelltheater (Reinforced Concrete Construction). Paper, 44 pp., 3 marks. Wilhelm Ernst & Sohn, Berlin Germany.

This publication contains an account of a number of experiments made by the Austrian Association of Engineers and Architects upon a large model of a theater, built of reinforced concrete, to observe the effect of fire upon the building.

Reinforced Concrete. A treatise on cement, concrete and concrete-steel, and their applications to modern structural work. By Walter Loring Webb, C. E., and W. Herbert Gibson, C. E. 129 pp. Cloth, $1. American School of Correspondence, Chicago, Ill.

This book is one of a series of practical working guides published by the American School of Correspondence for the use of its students, and is intended to embody at low cost and in convenient form the accumulated results of experience and the most approved modern practice.

Sixteen pages cover the discussion of cement, giving abstracts of the methods of testing of the American Society of Civil Engineers, with explanations and applications to practical work in the field. Another sixteen pages describes the ingredients of mortar and concrete and the machinery and methods of mixing it. Another deposits the concrete and finishes its surface, giving practical instruction regarding design and construction of forms.

The second part begins the study of reinforced concrete with sixteen pages on the general theory of flexure in reinforced concrete, which is the principal theoretical discussion in the book. This is followed by seventy pages applying the theory in a very practical manner to structural details, including slabs, beams, tanks, retaining walls, buttresses, box culverts, footings, curtain walls, wind bracing, columns, and tee-beams. The effects of variations in quality of concrete and steel are carefully considered, and the adhesion of steel and concrete with plain and deformed bars is fully discussed.

The book is practical, and its excursions into theory are only such as are at present necessary to make a basis for intelligent practice. The design of reinforced concrete structures is not yet reduced to its lowest terms, although considerable progress has been made in the past two or three years, and it is not yet possible to cover the whole subject both theoretically and practically in one book of reasonable size. This book confines itself as closely as possible to the practical side, and therefore gives its most valuable instruction in the designing of details and the operations of construction.

ORGANIZATIONS AND INDIVIDUALS

Technical Meetings—Civil Service—Personal Notes

Technical Meetings.

The twenty-third annual convention of the National Brick Manufacturers' Association will be held at Rochester, N. Y., February 1 to 6, 1909. The National Paving Brick Manufacturers' Association and the National Clay Machinery Association will be held February 1 and 2. T. A. Randall, secretary, Indianapolis.

The next convention of the Northwestern Cement Products Association will be held March 2, 3 and 4, 1909, in Minneapolis, Minn., at the Minnesota National Guard Armory. The committee in charge is composed of J. C. Van Doorn, R. O. Miracle, C. A. P. Turner and Harvey B. Smith.

The Chicago Cement Show will be held in the Coliseum, February 18-24, 1909.

The fifth annual convention of the National Association of Cement Users will be held at Cleveland, O., January 11 to 16, 1909.

The annual meeting of the Society of

Mechanical Engineers will be held in New York City, December 1 to 4. Calvin W. Rice, secretary, 29 West 39th street, New York City.

At the meeting of the New York Electrical Society held November 24, Dr. Clayton H. Sharp gave an informal address on "Some Recent Developments in Photometric Methods and Apparatus."

At the meeting of the Municipal Engineers of the City of New York, held November 25, Myron H. Lewis presented a paper on "Waterproofing an Engineering Problem." On December 5 the society will inspect the Pennsylvania Railroad tunnel under East River.

The membership of the English Institution of Municipal Engineers is now 366.

At the meeting of the Brooklyn Engineers' Club, November 12, Lawrence A. Ball presented a paper on "The Constructional Features of the St. Paul Auditorium of St. Paul, Minn.

The next convention of the American Society of Municipal Improvements will be held in Little Rock, Ark., November 3, 4 and 5, 1909. The city officials are already planning for the entertainment of the association and expect to exceed any previous demonstration of hospitality which it has experienced. The ladies accompanying members will receive particular attention. The daily press is calling upon the city to continue its efforts toward improvement in drainage, paving, etc., that they may conform with the handsome new city hall in which the sessions will be held.

The National Society for the Promotion of Industrial Education held its second annual convention in Atlanta, Ga., November 19, 20 and 21, advocating trade schools from all points of view.

The engineers and municipal officials of North and South Carolina met at Charlotte, N. C., November 17 and 18 and formed an association.

The next meeting of the Iowa Engineering Society will be held at Waterloo, Ia., on January 13 and 14, 1909. A. H. Ford, secretary, Iowa City, Iowa.

Civil Service Examinations.

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

December 9, 10: Assistant in the Naval Observatory, Navy Department, Washington, D. C., at $1,000 a year.

Personal Notes.

Augustus Alpers has been elected mayor at Westfield, N. J.

Walter A. Flint has been elected mayor at West Orange, N. J.

Arthur B. Seymour has been elected mayor at Orange, N. J.

Cornelius J. Kopp has been re-elected mayor at Boonton, N. J.

George E. De Camp has been elected mayor at Roseland, N. J.

Ralph C. Bach has been elected mayor at North Caldwell, N. J.

J. Henry Harrison has been elected mayor at Caldwell, N. J.

Dr. Victor Mravlag has been elected mayor at Elizabeth, N. J.

Frank Ward has been elected borough engineer at Ridgeway, Pa.

William Cardwell has been elected mayor at East Orange, N. J.

Charles O. McFadden has been re-elected mayor at Long Branch, N. J.

Hon. Henry V. Crawford has been re-elected mayor at Montclair, N. J.

Hon. Martin Behrman has been re-elected mayor at New Orleans, La.

John B. Marsten has been elected county surveyor of Lucas County, Ohio.

H. B. Dowling has been elected superintendent of water works at Eufaula, Ala.

Louis V. Ebert has been elected mayor and Aaron B. Crane freeholder at Roselle Park, N. J.

E. A. Smith has resigned as city engineer at Millville, N. J., to accept a position in another city.

Albert E. Smith has been elected city engineer at Warren, Ohio, to succeed E. M. Milligan, resigned.

Hon. Harry G. Stiles, mayor of Allentown, Pa., died in that city, November 7, of a stroke of apoplexy.

Mayor Bell was re-elected at Port Huron, Mich., November 10, and John Hoben was elected city clerk.

John McD. Gamewell, superintendent of the Hackensack Water Company, Hackensack, N. J., died recently.

J. F. de la Ossa, who was mayor of the city of Panama for fourteen years, is visiting in the United States.

J. D. Trammel has been appointed city engineer at Fort Worth, Texas, succeeding E. C. Woodward, resigned.

T. H. Brannon has been appointed assistant city engineer to succeed S. H. Falkenbach at Columbus, Ohio.

Hon. Edward A. Todd, former mayor of Owosso, Mich., died November 8, after an illness of two days, aged 80 years.

Edwin H. Rogers, M. Am. Soc. C. E., has been appointed city engineer at Newton, Mass., with headquarters at City Hall, West Newton, Mass.

Hon. Gustav Tafel, former mayor of Cincinnati, O., died at his home, 2539 Morman avenue, Walnut Hills, November 12, of a complication of diseases.

William B. Chase, formerly city engineer of Portland, Ore., died October 26 as the result of a stroke of paralysis received last February at McMinnville, Ore.

S. Bent Russell, M. Am. Soc. C. E., after several months absence from St. Louis, has returned to the city for permanent headquarters with offices at 415 Locust street.

Henry W. Taylor, assistant sanitary engineer for the New York State Department of Health, has been transferred to the position of sanitary engineer in the office of the New York State Architect.

Francis A. Murray, Charles A. Lemaster, Edward Cheetham, Richard J. Keeley and Harry W. Berryman have been elected members of the Common Council at Orange, N. J.

James M. Wood, inspector of street cleaning, Washington, D. C., has been promoted to superintendent of the department, succeeding John T. Twohey, who resigned recently.

Alfred A. Raymond, inventor of the Raymond concrete pile, and vice-president of the Raymond Concrete Pile Company, died recently at Regina, Canada. Mr. Raymond was born in 1848 at Lockport, N. Y.

Dr. Samuel Wesley Stratton, director of the bureau of standards, U. S. Department of Commerce and Labor, will delivers the Founder's day address at the

Thomas S. Clarkson Memorial School of Technology, December 1, 1908.

T. Hugh Boorman, general manager of the New York Mastic Works and the General Asphalt Products Supply Agency, has been elected president of the Knickerbocker Chemical Co., manufacturers of "Aquarex" for making cement construction waterproof.

G. S. Leavenworth, who for five years has been chief engineer for the Powers & Marshfield Company, engineers and contractors, has moved to Burlington, Vt., where he will take an active interest in the Vermont Construction Company, of which he is a stockholder and director. He will also engage in work as a consulting engineer.

A recent circular of the U. S. Forest Service announces the personnel of the force in the six districts into which the country has been divided. The district foresters in charge of these divisions are W. B. Greeley, Missoula, Mont.; Smith Riley, Denver, Colo.; R. C. Ringland, Albuquerque, N. M.; Clyde Leavitt, Ogden, Utah; F. E. Olmsted, San Francisco, Cal.; E. T. Allen, Portland, Ore.

MACHINERY AND TRADE

Concrete-Steel Floor Construction.

An interesting system of concrete-steel floor construction has been recently placed on the market. It is claimed to save from 4 to 12 cents per square foot of floor over any other system of floor construction now in use. The following is a general description:

It is a panel construction consisting of a flat slab of reinforced concrete supported by structural steel or reinforced concrete beams, which divide the ceiling into square or rectangular panels. The slab is reinforced by two independent layers of bars placed at the top and at the bottom the reof; the bars in the top layer are placed across the beams and over the columns, and the bars in the bottom layer run in two directions parallel to the beams of the panel. The bars in the top layer are preferably wired into units in advance and the units are dropped into place immediately after the concrete is cast.

The patentee of the system, Mr. Leibu Hermann, C. E., has issued a descriptive pamphlet, which will be sent free to interested parties. He will submit estimates and give suggestions as to the general design of any contemplated construction.

Something About Wood Blocks.

The U. S. wood block pavement consists of long leaf pine or Southern black gum impregnated under heat and pressure with a mixture of creosote and resin. The creosote makes the blocks rot-proof and the resin makes them waterproof, preventing the washing out of the preservative. Wood so treated is almost as inert under the influence of time as stone itself and under wear of traffic is more durable than stone. This is readily explained by the fact that the blocks are laid with the grain of the wood vertical. The wear of traffic coming on the end of the wood cannot split it, because the blocks are spread tightly "shoulder to shoulder" and have no further room to spread. The first few months of wear give a slight brooming action on the end fibres of the wood, mashing them down harder and harder, and closing up the joints, so that the pavement actually improves with age.

Tests after five years in Boston showed a decrease in depth of the block of less than three-eighths of an inch, and later tests showed no additional wear whatever. If not damaged by excavation, or if properly repaired after same, this pavement is practically indestructible.

A leading factor in its adoption has been its noiselessness under traffic. On this account, as well as its durability, wood pavements are in general use in European capitals, and New York City has adopted it for the office building district. Being waterproof it is absolutely sanitary, and being smooth and tightly joined it is readily cleaned.

After eight years of use in many sections of the country, practically no repairs on account of wear have yet become necessary upon any street paved with U. S. wood blocks. Booklets and further information will be sent on request to the U. S. Wood Preserving Co., 29 Broadway, New York City.

Economy of Tarvia Treatment of Roads.

In a paper before the Illinois Society of Engineers and Surveyors, Linn White, the engineer of the Chicago South Park Commission, said:

In 1905, South Park avenue from Thirty-third to Thirty-fifth street, was reconstructed and paved with macadam 12 inches thick. The cost of construction was $1.25 per square yard. In 1906 it was repaired and rerolled at a cost of 2¾ cents per square yard. In 1907 about 6 cents per square yard was expended in

maintenance, and it is now estimated that it will cost at least 20 cents per square yard to resurface and carry it through the season of 1908 in good shape as a plain macadam street. This is a maintenance cost of about 10 cents per square yard per year for the period of three years, exclusive of sprinkling and cleaning. This means the round of repairs and resurfacing would only be begun over again at a gradually increasing cost each year. In its present condition there are numerous depressions 1 to 2 inches deep and a sprinkling of loose stone may be seen over the surface loosened and thrown up by the automobiles.

In 1906 two miles of Grand Boulevard were treated with Tarvia at a cost of 6 cents per square yard, plus a trifle for a little new stone used in redressing. In June, 1907, three blocks were spiked up and re-treated with Tarvia. The rest of it, thirteen blocks, remains in fair condition up to date with not more than 5 per cent repaired in 1907. It may be expected to go through the season of 1908 with a very small percentage of repairs.

The entire surface of Grand Boulevard has since been treated at a cost of 2½ cents per square yard, making a total cost for the Tarvia treatment and three years' maintenance of less than 9 cents per square yard, which contrasts favorably with the 28¾ cents required on the South Park extension of the same street.

The thoroughfare upon which this work was conducted carried a traffic of 2,300 automobiles and 800 horse-drawn vehicles per day, with a greater number on Sunday. It presents, therefore, as hard a test as could reasonably be asked of a macadam road. In fact, many engineers consider it necessary to use a pavement instead of macadam for so heavy a traffic.

It should be borne in mind also in connection with this work that the cheaper tarviated road was dustless, whereas the South Park avenue extension with its high maintenance cost required continual sprinkling with water and even then was a source of complaint to residents and pedestrians.

A Portable Asphalt Plant for Use in Repairs and Small Works.

The A1 plant of the Guelich Portable Asphalt Plant Co., Chicago, consists of a portable asphalt mixing plant, resting upon a strong iron track frame inclosed in a sheet iron housing that incloses a cylindrical mixing drum, supplied inside with mixing blades revolving upon its axle in a gyratory way, over a fire under the iron frame upon which the whole structure rests. Bins for drying sand or stone are arranged in a perpendicular manner inside the housing, in which sand and stone are dried and heated by the same fire.

The plant is transportable by means of horsepower or traction engine, from one locality to another. It has a capacity of 125 yards of 2-inch pavement per day. The weight of the plant is 6,000 pounds and it costs $1,500 in Chicago.

The city of Milwaukee has one for general street work, working very successfully and satisfactorily. The Union Stock Yards, Chicago, has several for mastic work. The plant is recommended for small work, but it has not so great a capacity as the B1 plant, and is not so completely arranged for large work. It is stated by the makers that old discarded sheet asphalt pavement can be successfully manipulated in this plant and made as good as new.

J. P. Sherer, commissioner of public works in Milwaukee, says: "We find in utilizing our old material that we have reduced the cost of repair very materially, in addition to having the breaks in our pavements repaired in a manner which we deem as good as, if not better than, the work done by the parent company.

Cement Factories in Operation.

The directory of Portland cement manufacturers having plants in operation in 1908, which is issued by the Association of American Portland Cement Manufacturers from its Philadelphia office, is a little book of 73 pages which contains the names of all the operating cement mills in the United States. It also contains a list of the officers of the various companies arranged in alphabetical order; a list of the mills arranged in accordance with their geographical location by States; and two folding maps, one of the United States and the other of the Lehigh District, showing the location of the operating mills in the United States.

Something New in Advertising.

"And he preached a sermon that was lacking in originality but was full of pungent truths."

This is the appeal for interest which appears on the outside cover of a rather unique booklet which comes from Charles Warner Company, Wilmington, Del. Without the faintest suggestion of what is to be offered to the reader in the pages which follow, this sentence commands immediate interest and not one man in a hundred would lay this piece of printed matter aside before proceeding to investigate the interior, and with such investigation his interest would increase as he proceeded. This booklet has succeeded where many more elaborate pieces of advertising fail, holding and increasing the reader's interest after awakening it. The booklet treats of "Quality in Lime Mortar" and "Quality in Cement Mortar and Concrete," and the "sermon" consists of clippings from articles written by authorities on the subject, which are pasted to the leaves of the booklet. "He presented no arguments, but cited truths drawn from many eminent sources, hoping that these would inspire arguments in the minds of his readers." The net result is that the reader has read quite a complete scientific discussion on hydrated lime be-

fore he realizes it and the booklet has accomplished its mission.

The matter contained in the clippings very satisfactorily serves the purpose for which the book was evidently intended, which is to create an interest in the proper use of hydrated lime.

Steel Centers for Culverts and Sewers.

The steel centers for use in constructing all shapes and sizes of concrete or brick sewers, manholes, culverts, conduits, ducts, subways, pipe, drains, arches, cisterns, etc., are built of any length or diameter. The construction is extremely simple and the process of collapsing and removing the centering after the work is complete is also very simple. Molds for sewers from 12 to 48 inches in diameter and 4 to 6 feet in length are standard size, but any other sizes can be furnished. Each mold is adjustable within a range of 3 inches or so in diameter of sewer. Centers for egg-shaped sewers are also supplied of any size desired, the usual sizes being from 12 by 18 to 36 by 54 inches. A recent circular of the manufacturers shows a cement culvert with center in position, another with 36-inch center collapsed ready for removal and a sewer center 48 inches in diameter in place in the trench. Full information can be obtained from the Adjustable Steel Centering Co., Fond du Lac, Wis.

The Corrugated Bar Company.

The company known heretofore as the Expanded Metal and Corrugated Bar Co. will be known after December 1 as the Corrugated Bar Co. The change is made because for several years the main business has been the sale of corrugated bars and it was thought best to recognize this in the name. The old and new forms of the bars have great popularity, undoubtedly because of the efficiency and adaptability to all classes of reinforced concrete construction. The new company will have its offices at 1410-19 National Bank of Commerce building, St. Louis, Mo.

Sicilian Asphalt Macadam Pavement.

The Sicilian Asphalt Paving Co., of 41 Broadway, New York, laid some two years ago a section of the western end of the Pelham Parkway in Bronx Borough near the north gate of the Zoo, with an asphalt macadam which has been quite successful, so that a new section with an area of 21,000 square yards has been laid this year, passing the entrance to Hunter's Island. The materials used are stone, trap rock screenings and "asfalto," which is a combination of materials, but mainly a high grade of asphalt. The roller used is a puddling roller having a smooth wheel at one end and a large corrugated wheel at the other.

In constructing the road the foundation, which may be an old macadam road, is rolled, the corrugated roller having a tendency to bind the stones in the foundation more firmly together and form slight depressions in the surface, which aid in binding the asphaltic coat to the base. After this rolling the surface layer of broken stone is put on and the melted asfalto is poured over it from cans adapted to the purpose, after which the surface is sprinkled with fine trap rock screenings and the pavement is thoroughly rolled with the corrugated roller, which thoroughly incorporates the stone, the screenings and the asfalto. The surface of the base must be parallel to the surface of the pavement, otherwise the surface will become as uneven as the base. There is no loose material on the surface to form dust and it has the rough projections of the particles of stone to prevent slipperiness.

Repairs are made by pouring the melted asfalto over the exposed sub-surface and sprinkling it with the screenings, which are rubbed in with the back of a rake. Traffic can be turned on immediately after the completion of the repair.

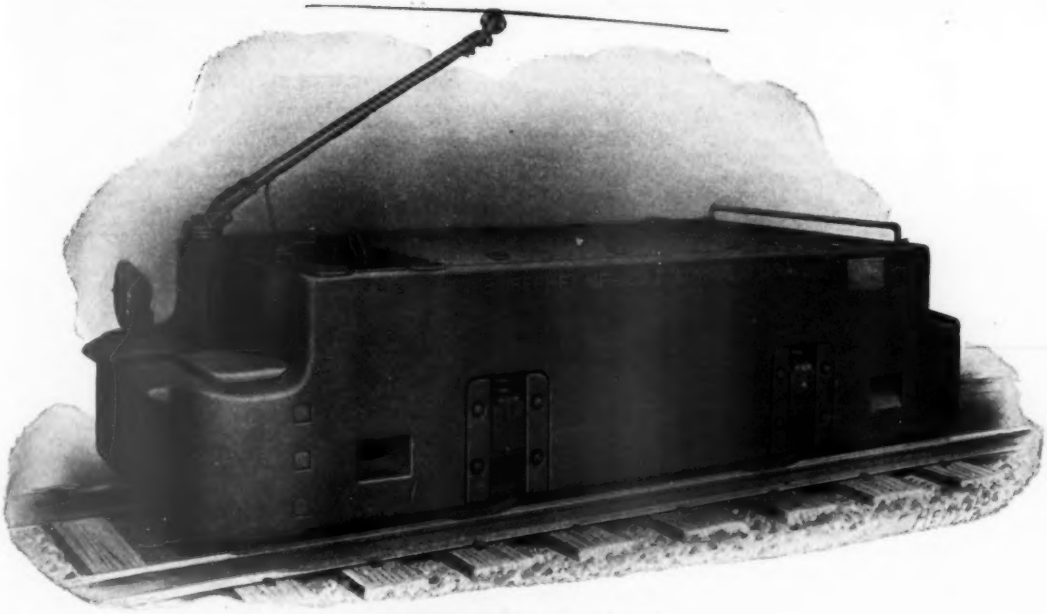
Variations in hardness and resilience of the pavement can be made to meet all conditions of traffic up almost to the hardness of a standard asphalt pavement.

Full details of prices, materials and cost can be obtained by writing to the company.

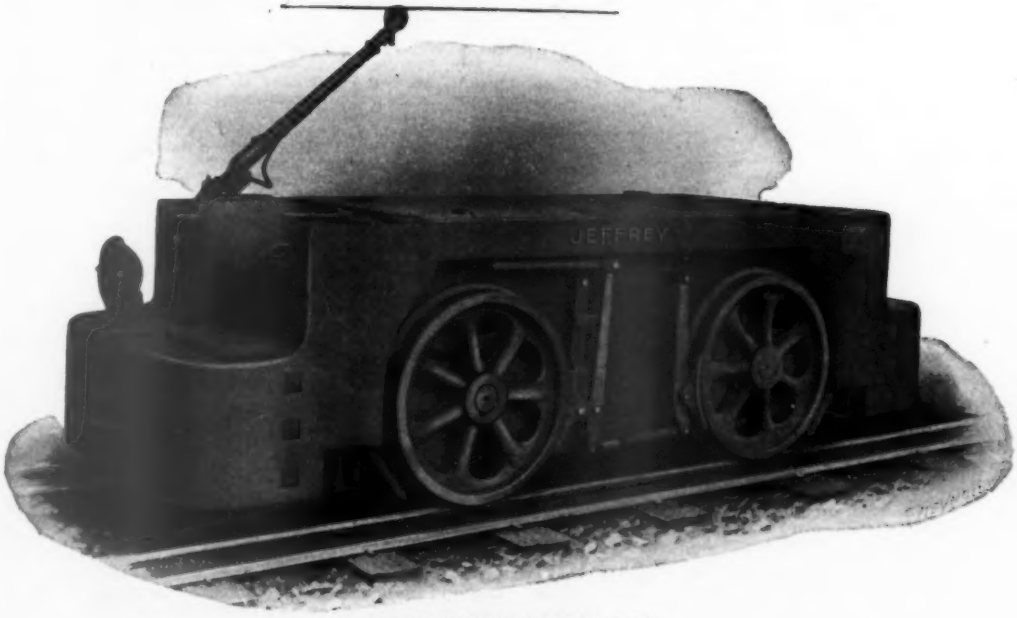
Mine Locomotives.

The accompanying illustrations show recent types of electric mine locomotives as built by the Jeffrey Manufacturing Company of Columbus, Ohio, in which they have striven to embody the latest ideas in mine locomotives and street railway motor construction. Every part has been made amply strong and simplified as far as possible without eliminating any of the desirable features. The designs are such as to secure the smallest over-all dimensions and at the same time allow access to all of the parts. The motors represent the latest ideas in railway practice, such as drum armatures with form wound coils, laminated pole pieces, ribbon-wound field coils impregnated with solid compound, oil lubrication with auxiliary grease boxes, and liberal wearing surfaces. The magnet frames are arranged so that the complete motor may be removed from the locomotive by taking off the axle caps, or the frame can be taken apart and the armature removed with very little trouble.

The inside wheel type is to be preferred where the mine entry is wide enough to accommodate the increased width; as the wider locomotive allows more space for the electrical equipment and consequently easier access to the motors, rheostat, controller, etc.



JEFFREY MINE LOCOMOTIVE,
Outside Housing.



JEFFREY MINE LOCOMOTIVE,
Inside Housing.

Fire Alarms on Wooden Railway Bridges in Canada.

Experiments are being made by Canadian railroad companies with a device in the nature of automatic fire alarm for installation on wooden bridges. This device consists of thermostats, which, in case of a bridge being burned, will electrically ring a gong and set a semaphore at danger, and at the same time sound an alarm at the nearest station.

Trade Publications.

The Semet-Solvay Company, Syracuse, N. Y., send a pamphlet descriptive of crysolite protective paint and its uses.

The Harbison-Walker Refractories Co., Pittsburg, Pa., have a well-illustrated booklet on the use of their fire brick and block in lime kilns.

Spiral riveted pipe and connections and exhaust steam and hydraulic supplies are the subjects of catalog No. 5 of the American Spiral Pipe Works, Chicago.

The Meramec Portland Cement and Material Co., St. Louis, Mo., sends a detailed report giving results of an investigation of the company's process of waterproofing Portland cement.

The Luten truss is shown and methods of using it are described in a pamphlet issued by the National Concrete Co., Indianapolis, Ind.

The October number of "Designing Methods, Reinforced Concrete Construction," issued by the Expanded Metal and Corrugated Bar Co., now the Corrugated Bar Co., St. Louis, Mo., is devoted to the design of retaining walls of the cantilever and buttress types.

The November bulletin of the Universal Portland Cement Co., Chicago, Ill., shows the rebuilding of the Chicago Union Stockyards in concrete, including fences, watering troughs, receiving platforms, cattle pens, etc. It also shows three styles of surface finish of concrete in three sizes of aggregate.

The Peterson balanced valves for reservoirs and pipe lines are described in a circular issued by the inventor, J. Peterson, New York City.

Trade Notes.

CEMENT.

Chicago, Ill.—The Francis Mills Cement Co. has been incorporated to deal in cement and do general contracting, by Francis Mills, Bohumil J. Wacek and James F. Forsyth.

Gloucester, Mass.—The Russia Cement Co., of this city, has opened its plant at Anacortes, Wash., work on which began in July, 1907.

Asotin, Wash.—The Portland Cement Co. is, according to press reports, rushing work on the construction of the cement plant on the upper Snake River.

Three Forks, Mont.—A large Portland cement plant is to be established here.

Elk Rapids, Mich.—The coal house of the Elk Rapids Cement & Lime Company's plant here was destroyed by fire October 28.

CONCRETE BLOCKS.

Farnhamville, Ia.—Fred Coates has sold his interest in the cement block and tile plant to his partner, E. H. Rushton, who will continue the business.

Avery, Ia.—Frank West will engage in the cement block business.

Mill Valley, Cal.—Joseph A. Hoffman has patented a new form or shape of brick, to be reinforced after the manner of reinforced concrete, with iron straps, rods or bands of wire. The bricks or blocks have grooves or perforations, or both. The perforations go through the narrow way of the brick and extend half through the width. The grooves go lengthwise or crosswise, so that the reinforcement may rest therein. They permit reinforcement vertical and horizontal. The intention is to attach the various sections of reinforcement to one another by means of welding eyes or perforations, and the top is to be anchored or riveted through a plate of steel or iron. Mr. Hoffman claims that all of the advantages of reinforced concrete construction are gained by this method, without the labor and expense of wooden forms, and that the greater strength of the reinforced brick construction will permit of brick walls being at least one brick thinner than under the present method of building, thereby saving expense.

PURCHASE OF MACHINERY.

Huntsville, Ala.—Special.—R. E. Smith, mayor, advises us that he is in the market for a street sweeper. He desires a machine that will sprinkle and sweep.

Clarksville, O.—Special.—A. H. Stanfield is in the market for a complete line of concrete machinery and desires catalogues of same.

Horton, Kan.—Special.—Al Frey is in the market for a small stone crusher.

Minneapolis, Minn.—Special. The Minnesota Paving Brick Co., 10 N. 3rd st., is in the market for a machine to take stone out of clay.

Rockville, Ind.—Special. Chas. E. Hungerford, R. F. D. 3, advises us that he desires a price list of tools.

Chillicothe, O.—Special. Walace D. Yaple, mayor, advises us that he desires plans for a fire engine house.

PURCHASE OF MATERIALS.

Covington, La. — Special. — Edw. H. Richard, city attorney, is in the market for crude oils, etc., for streets.

West Branch, Mich.—Special. C. J. Phelps is in the market for materials for sewer construction.

MISCELLANEOUS.

Cincinnati, O.—The Fitch Dustdown Co. has been incorporated by J. B. Fitch, E. A. Townsley, E. W. Townsley, A. M. Loop and D. W. Lewis.

Chicago, Ill.—Special.—Robert W. Hunt & Co., consulting and inspecting engineers, 1121 The Rookery, Chicago, Ill., have been awarded by the Chicago & Northwestern Railroad Co. the inspection of the structural materials entering into their new terminal station, of which the steel will amount to about 240,000 tons. The same firm has been given the inspection of the steel to be used in the new Blackstone Hotel now being erected at the corner of Michigan avenue and Hubbard Court.

Patents Concerning Concrete Walls.

849,126. Mold for Forming Walls. Wm. D. Ham, Knoxville, Tenn.
849,664. Retaining and Supporting Frame for Wall-Molds. Reed Deeds, Cuyahoga Falls, O.
849,885. Concrete Form. Joseph M. Carmody, Washington, D. C.
850,120. Mold for Concrete Walls. Wm. H. Anthony, Allentown, Pa.
850,758. Making Concrete Walls. Fred M. Jackson, Akron, N. Y.
852,534. Mold for Hollow Wall Construction. D. O. Wilson, Yankton, S. D.
853,837. Mold for Concrete. Henry A. Steber, Utica, N. Y.
854,098. Concrete Wall Form. Oscar F. Mann, Indianapolis, Ind.
858,370. Core for Making Hollow Plastic Walls. Wm. N. Carroll, Minneapolis, Minn.
860,479. Concrete-Building Mold. John L. Ingersoll, Richmond, Ind.
860,565. Concrete Wall. John L. Peetz, Kokomo, Ind.
861,499. Cement Partition. Martin Carroll, Kansas City, Mo.
861,600. Means for Attaching Articles to Concrete Walls. Harry McCann, Hamilton, Ont., Can.
864,283. Brick and Wall Constructed Therewith (and Concrete). Elmer D. Andrus, South Chicago, Ill.
864,452. Building Construction. Lewis K. Davis, New York, N. Y.
864,619. Composite Structure. Alphonse De Man, New York, N. Y.
864,767. Building Mold. John D. Brickford, Cleveland, O.
867,954. Wall Construction. Geo. E. Davis, Dubuque, Iowa.
868,284. Mold for Veneering Wall with Cement. Jas. G. Mills, Toronto, Ont.
868,764. Mold for Concrete Walls. M. J. Demorest, Belding, Mich.
870,881. Method of and Apparatus for Making Walls. Wm. D. Ham, Knoxville, Tenn.
871,327. Apparatus for Constructing Walls of Concrete. Chas. Dietrichs, Little Ferry, N. J.
871,879. Concrete Wall or Column Construction. Wm. E. Middleton, Kansas City, Mo.
872,750. Mold for Concrete Walls. Jno. I. Richardson, Bloomsburg, Pa.
873,138. Mold for Concrete Work. Frederick M. Stults, Chicago, Ill.
873,739. Reinforced Interlocking Concrete Wall. Robert Edmondson, South Bend, Ind.
873,760. Molding Apparatus. Chas. H. Latham, Bradford, Pa.
875,700. Mold (continuous faces). Paul T. C. Dumais, Hull, Quebec, Can.
875,983. Concrete Construction (Wall). John B. Clayton, Kirkwood, Mo.

Patents Concerning Concrete Building Construction.

849,819. Fireproof Column. John J. Tresider, New York, N. Y.
850,948. Building Construction. August Mohr, Stuttgart, Germany.
851,573. Plastic Structure. Ludwig A. Tye, Guillaume Boivin and Louis N. Benjamin, Montreal, Que.
852,665. Separator for Girders. Chas. H. Kellogg, Buffalo, N. Y.
852,971. Masonry and Concrete Structure. Daniel B. Luten, Indianapolis, Ind.
853,802. Building Construction. Wm. H. Keyser, Wills Point, Tex.
853,951, 853,952, 853,953, 853,954, 853,955, 853,956, 853,957. Centering and Ceiling Molds and Centering Devices. Jacob B. Blaw, Pittsburg, Pa.
854,818. Concrete Hanger Insert. Ferris L. R. Francisco and Jas. C. Thorn, New York City.
855,442. Apparatus for Raising Concrete Forms. Russell H. Folwell and Wm. R. Sinks, Chicago, Ill.
856,371. Centering Construction. Chas. H. Scammell, New York, N. Y.
857,586, 857,587, 857,588. Apparatus for and Method of Making Monolithic Hollow Objects. Jas. M. Boyle, New York City.
857,589. Means and Method for Continuously Making Tube-Lined Monolithic Hollow Objects. Jas. M. Boyle, New York City.
857,821. Building Construction (Concrete Column). Edward McClure, Chicago, Ill.
858,227. Concrete Construction. Walter S. Shourds, Philadelphia, Pa.
858,448. Cement Facing for Floors. Sterne H. Gartrell and Wm. E. Middleton, Kansas City, Mo.
858,924. Centering for Reinforced Concrete Work. C. A. P. Turner, Minneapolis, Minn.
859,511. Concrete Floor Construction. Louis H. Nolte, Cincinnati, O.
859,954. Construction for Drying Walls and Neutralizing Saltpeter Therein. Max Leser, Munich, Germany.
862,681. Fireproof Column. John J. Tresidder, New York City.
863,760. Fire Proof Stair Structure. Edward E. Schachner, Denver, Colo.
865,265. Concrete Construction. Albert A. Pauly, Youngstown, O.
865,336. Building Structure. Howard S. Gardner, Cape May, N. J.
867,252. Building Construction. Lewis K. Davis, New York, N. Y.
869,518. Concrete Chimney. John W. Rector, Savannah, N. Y.
869,789. Columns for Fireproof Construction. John Lally, Boston, Mass.
869,869. Column. John Lally, Waltham, Mass.
870,905. Stair Construction. Edward E. Schachner, Denver, Colo.
872,954. Building Construction. Edgar D. Martin, Chicago, Ill.
874,395. Column Construction. Daniel B. Danielson, Milwaukee, Wis.
874,461. Concrete Structure and Hanger Support. Arthur F. Walker, Atlanta, Ga.
875,396. Clamp for Use in Building Construction. Herbert E. White, Youngstown, O.
880,468. Brace for Concrete Structures. Albert J. Robinson, Washington, D. C.
881,183. Cement Column. Richard H. Guyer, Lafayette, Ind.
882,196. Method of Building Monolithic Walls. Howard H. Hahn, Kenosha, Wis.
882,482. Construction of Buildings. Chas. H. Wilson, Red Oak, Iowa.
883,434. Centering for Fireproof Floor Constructions. Guy B. Waite, New York, N. Y.

Patents Concerning Cement and Its Uses.

849,704. Concrete Block Machine. Augustus O. Thomas, Kearney, Neb.
849,798. Composite Railroad Tie. Joseph LeFavour and Robert F. Braummer, Albany, Ind.
849,922. Reinforced Concrete Construction. Edson M. Scofield, Philadelphia, Pa.
850,491. Gyratory Crusher. Oliver C. Redding, Chicago, Ill.

850,667. Cistern Former. Chas. A. Mitchell, Indianapolis, Ind.

850,676. Brick Machine. David P. Sanders, Reading, Pa.

851,169. Concrete Reinforcement. Geo. Ibach, Detroit, Mich.

851,395. Mold and Centering Device for Sewers, Conduits, etc. Jacob B. Blaw, Pittsburg, Pa.

851,405. Rail Fastening Device. Jas. P. Crerar, Denison, Tex.

851,406. Manufacture of Sand-Lime or Composite Brick or Stone. Allen S. Crocker, Rochester, N. Y.

851,408. Bridge Abutment (Reinforced Concrete). Andrew O. Cunningham, St. Louis, Mo.

851,553. Concrete Mixing Machine. Alvin F. Nims, Philadelphia, N. Y.

851,554. Concrete-Measuring Machine. Alvin F. Nims, Philadelphia, N. Y.

851,601. Cement Railroad Tie. Erness Legg and Geo. H. Wright, Granville, O.

12,639 (Reissue). Contractible Mold. Geo. Georgenson and Joseph E. Hennen, Fond du Lac, Wis.

852,202. Reinforced Concrete Arch. Henry M. Russell, Jr., Wheeling, W. Va.

852,230. Floor Construction. Julius Kahn, Detroit, Mich.

852,500. Process for Manufacturing Bricks. Laurence Elkus, Indianapolis, Ind.

852,898. Truss for Reinforcing Concrete Construction. Wm. E. Owens and Jas. E. Wright, Omaha, Neb.

852,970. Bridge of Concrete or Other Analogous Material. Daniel B. Luten, Indianapolis, Ind.

853,183. Concrete or Similar Arch. Daniel B. Luten, Indianapolis, Ind.

853,202, 853,203, 853,204. Arch Structures. Daniel B. Luten, Indianapolis, Ind.

853,354. Waterproofing Compound. August Gross and Aaron C. Horn, New York, N. Y.

853,456. Concrete-Heating Machine. Robert C. Huffman, Baltimore, Ind.

853,623. Concrete Mixer. Frank A. Borst, South Bend, Ind.

853,640. Core for Concrete Walks. Joseph H. Landry, Appleton, Wis.

853,945. Concrete Mixer. Chas. L. Baldwin, Waterloo, Iowa.

854,397. Culvert. Fred S. and Fitch H. Beach, Charlotte, Mich.

854,524. Supporting Structure for Building Culverts and the Like. Edward F. Parcaut, Sutherland, Iowa.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Paterson, N. J.—The members of the board of freeholders made a tour of inspection November 9 in the upper section of Passaic County, expressing approval at the excellence of the roads.

Milwaukee, Wis.—Charles J. Poetsch, city engineer, and the members of the commission of public works and other city officials visited Whiting, Indiana Harbor and Hammond, Ind., November 9, to investigate bituminous macadam paving. Experiments will be made here with the material next year.

CONTEMPLATED WORK.

Austin, Minn.—This city will construct 2 miles of paving next year.

Grinnell, Ia.—The question of street paving is being renewed.

Tweed, Ont.—This city has been authorized to expend $5,000 for granolithic walks.

Poughkeepsie, N. Y.—The estimated cost of paving upper Main st. is about $35,000.

North Yakima, Wash.—About 2 miles of Summit View road will be paved with petrolithic.

Cleveland, Tenn.—Plans and specifications will be prepared for constructing sidewalks.

Lewiston, Mont.—Council is considering a plan for boulevarding the streets of this city.

Bellingham, Wash.—A resolution has been passed authorizing the improvement of Kentucky st.

Clinton, Tenn.—Voted to issue $15,000 bonds for street improvements. W. T. Walker, cy. clk.

Eminence, Ky.—Voted to issue $15,000 bonds for the improvement of the streets. F. S. Moody, cy. clk.

Kansas City, Mo.—An ordinance is pending providing for creosoted wood block paving in 14th st. from Wyoming to Hickory.

La Crosse, Wis.—The county board adopted, Nov. 14, a system of county highways including approximately 100 miles of roadway.

Pullman, Wash.—This city has authorized the creation of improvement districts for constructing about 10 blocks of macadam paving.

Beamsville, Ont.—The Ontario Railway and Municipal Board has authorized this city to expend $11,000 for constructing granolithic walks.

Lemoyne, Pa.—Voted to issue $15,000 bonds for opening, grading and improving the street in this borough. Oscar Wolfensburger, secy. coun.

Atlantic City, N. J.—Ordinances have been passed providing for the improvement of a large number of streets with macadam, asphalt and vitrified blocks. Harry Wootton, cy. solic.

Frederick, Md.—The Business Men's Association inaugurated a movement,

November 13, to bring to the attention of Congress the advantages of the route to Gettysburg via Frederick, for the proposed Lincoln Memorial Boulevard.

Shawnee, Okla.—Special.—F. D. Brown, cy. engr., says that contracts will be shortly let for constructing about 6 miles or more of asphalt paving. Contracts were let June 20 and Oct. 31 for about 11 miles of brick and asphalt paving.

Kansas City, Mo.—Resolutions have been adopted for paving Eighth, Wyoming, McCoy, Scarritt, S. Benton and Seventh sts. and constructing granitoid sidewalks in Mersington, Walrod, Harrison, Kensington and other streets. J. L. Darnell, cy. engr.

Altus, Okla.—Special.—E. E. Hudson, cy. engr., says the town council has ordered the construction of concrete walks on both sides of 4 miles of streets, and expects to build, next spring, about 30 additional miles of walks. H. C. Gilliland, cy. clk.

CONTRACTS TO BE LET.

Olympia, Wash.—Bids are asked until Dec. 4 for constructing State aid road No. 27. State Highway Bd.

Wabash, Ind.—Bids are asked until Dec. 8 for grading, draining and gravelling a highway in Waltz twp. J. P. Noftzger, co. audt.

Vernon, Ind.—Bids are asked until Dec. 7 for constructing 2¾ miles of pike road in Vernon twp. I. L. Thomas, co. audt.

Lafayette, Ind.—Bids are asked until Dec. 9 for constructing the Bender gravel road in Wabash twp. John P. Foreman, co. audt.

St. Paul, Minn.—Bids are asked until Dec. 21 for macadam and gravel work in Bald Eagle Lake ave. E. G. Krahmer, co. audt.

Muncie, Ind.—Sealed bids are asked until Dec. 9 for grading and paving certain public highways with gravel. Jos. E. Davis, co. audt.

Newton, N. J.—Bids are asked until Dec. 17 for grading and macadamizing about 10 miles of public road. Loren C. Cole, dir. bd. freeholders.

Vincennes, Ind.—Bids are asked until Dec. 8 for constructing 2 gravel roads, 3,205 and 1,300 feet respectively. John T. Scott, co. audt.

Bloomfield, Ind.—Sealed bids are asked until Dec. 8 for constructing a gravel and macadamized road in Stockton twp. Peter M. Cook, co. audt.

Corydon, Ind.—Sealed bids are asked until Dec. 9 for constructing free gravel roads. Thos. J. Stevens, chmn. co. comrs., Frank E. Watson, co. audt.

Muskegon, Mich.—Sealed bids are asked until Dec. 7 for grading and paving Sumner and Giddings sts. with brick and paving an alley. B. H. Tellman, cy. recdr.

Fort Riley, Kas.—Sealed bids are asked until Dec. 14 for constructing macadam roads, curbing and guttering, catchbasins and grading. Capt. W. M. Whitman, const. Q. M.

CONTRACTS AWARDED.

Chanute, Kas.—The contract for macadamizing about 1¼ miles of turnpike was awarded to C. L. Besler for $5,872.

Little Rock, Ark.—Joseph McCoppin was awarded the contract for paving S. Main st. with brick for $56,000.

Hartford City, Ind.—The contract for constructing a macadam road was awarded to Charles Ciame for $12,403.

Albany, N. Y.—The contract for paving Sherman st. was awarded to John M. Holler, of this city, for $6,534.

North Yakima, Wash.—The contract for improving N. Front st. was awarded to W. G. Aumiller at 59c a lin. ft.

Ottawa, Kas.—Ransom & Cook secured the contract for paving 15,300 sq. yds. of Locust and Maple sts. with macadam.

Gurdon, Ark.—The contract for paving ½ mile of sidewalks with brick was awarded to the Gurdon Brick Co., of this city.

Boston, Mass.—The contract for paving Zeigler st., Roxbury, was awarded to the Rudolph S. Blome Co., of Chicago, for $2,359.

Columbus, Miss.—The contract for constructing 33,000 ft. of concrete sidewalk was awarded to P. C. Campbell, of this city.

Salem, N. H.—The contract for constructing 4,000 ft. of macadam road was awarded to Edward Adams, of North Andover, Mass.

Detroit, Mich.—The contract for paving Michigan ave. with brick was awarded to F. Porath & Sons, 878 25th st., for $11,200.

Portland, Wash.—The contract for constructing 2½ miles of bitulithic paving was awarded to the Warren Construction Co. for $160,000.

Cumberland, Md.—The contract for curbing and paving sidewalks in Springvale ave. was awarded to Christopher Roeder, of Cumberland, for $4,144.

Weehawken, N. J.—The Layton Fire Clay Co., of McKeesport, secured the contract for furnishing 7,000 sq. yds. of brick paving to this city.

Argentine, Mo.—The contract for paving Metropolitan ave. was awarded to the Kansas City Bitulithic Co., of Kansas City, for $50,000.

Sunnyside, Wash.—The contract for graveling ½ mile of the Mabton Sunnyside road was awarded to A. F. Latten at 80 cts. a cu. yd.

Tampa, Fla.—The contract for constructing the Clearwater and Dunedin road was awarded to Bryan & McConnell at 45c a sq. yd. and 20c for grading.

Lawton, Okla.—The contract for constructing 26,490 sq. yds. of paving in Avenue D was awarded to Charles H. Shaw, of Muskogee.

Los Angeles, Cal.—The contract for paving Downey ave. with asphalt was awarded to the Barber Asphalt Co. for $92,969.51.

Nampa, Idaho.—The contract for bitulithic paving in paving district No. 6 was awarded to the Warren Construction Co. for $128,996.45.

Charleroi, Pa.—Hastings, Owens & Piper, of this city, secured the contract for paving Lincoln ave., and the Mack Mfg. Co., of Pittsburg, the contract for furnishing brick for the street.

Naugatuck, Conn.—The contract for constructing 3,700 lin. ft. of macadam and telford road was awarded to O. L. Benedict, of Pittsfield, Mass., at $1.75 and $2.25 respectively.

Waynesburg, Pa.—Frederick Robinson, of Meadville, was awarded contracts for constructing 3 miles of road in Center twp. for $50,504.21, and 3,758 ft. in Franklin twp. for $15,252.13.

South Windsor, Conn.—The contract for constructing 12,390 lin. ft. of macadam and telford road was awarded to Thos. Kearney at $1.47 a lin. ft. for macadam and $2.60 for telford.

Dawson, Pa.—The contract for paving Howell st. was awarded to the Thomas Sweeney Co., 4906 Cypress st., Pittsburg, and Louis Costa, of Dickerson Run, Pa., secured the contract for stone curbing.

Crawfordsville, Ind.—The contract for

constructing the W. C. Lynch et al. macadam road was let to Gardner & Scribner for $8,250. Milroy & Holt secured the contract for constructing a road in Ripley twp. for $6,540.

Lapel, Ind.—The contract for grading and paving Pendleton ave. was awarded to the Burke Bros. Construction Co., of Anderson, for $6,720. W. Ewing Shields, of Noblesville, was awarded the contract for constructing Woodward road No. 2 for $2,032.80.

Kansas City, Mo.—Contracts for paving were awarded Nov. 5 as follows: Asphalt paving, to Parker-Washington Co., about 20,240 sq. yds., $1.90 to $2.25 per sq. yd.; Cleveland Trinidad Paving Co., 9,844 sq. yds., $1.90 to $1.98 per sq. yd., and Barber Asphalt Paving Co., 1,443 sq. yds., $2.31 per sq. yd.; and to Wm. Harte, for 2,246 sq. yds. creosoted block pavement, $2.49 per sq. yd.

Oklahoma City, Okla.—Contracts for grading and street paving were awarded Nov. 4 as follows: For asphalt pavement, Conway Paving Co., 138 Washington St., Chicago, Ill., $217,159; Parker-Washington Co., 4500 Duncan Ave., St. Louis, Mo., $418,820; and Cleveland Trinidad Paving Co., Cleveland, O., $27,099; for alley brick pavement, Joseph A. Hanna Co., of Oklahoma City, about $1,800; for grading streets and alleys a distance of about 14 miles, Bennett & Acklin Co., and J. R. Alley Co., at $50,000. Total cost, $813,879.

Brooklyn, N. Y.—The contract for asphalt paving on concrete foundation in Blake ave. was awarded to the Uvalde Co., 1 Broadway, New York City, as follows: 9,010 sq. yds. asphalt pavement, including binder course, outside of railroad franchise area (5 years' maintenance), $1.30; 23 sq. yds. asphalt pavement, including binder course, within railroad franchise area (no maintenance) $1.30; 1,254 cu. yds. concrete, outside of railroad franchise area, $6; 2 cu. yds. concrete, within railroad franchise area, $6; total cost, $19,285. Other contracts awarded for paving are as follows: 84th st., from 18th ave. to 21st ave., 7,620 sq. yds., to Barber Asphalt Paving Co., 30 Church st., New York City, $17,485; Hinsdale st., from Sutter ave. to Riverdale ave., 7,660 sq. yds., to Cranford Co., 190 Montague st., Brooklyn, $16,194; Rochester ave., from St. Mark's ave. to Boule, 7,020 sq. yds., Cranford Co., $14,838; Sutter ave., from Rockaway ave. to Saratoga ave., 6,440 sq. yd., Cranford Co., $13,618.

Albany, N. Y.—Contracts for constructing good roads were awarded Nov. 11 as follows: Reservation road, Seneca county, to F. A. Bortsch, Rochester, $35,155; Sprakers-Rural Grove road, Montgomery county, Central and Eastern Construction Co., Albany, $75,722; Canajoharie-Sharon Springs road, Montgomery county, Joseph Walker, New Paltz, $25,278; Oak Orchard road, Orleans county, F. A. Bortsch, Rochester, $18,342; Philadelphia road, Jefferson county, Buckley Construction Co., Plattsburg, $41,609; Salisbury Center-Stratford road, Herkimer county, Rockefeller Bros., Brooklyn, $38,839; Buffalo road, Monroe county, F. W. Knickenburg, Buffalo, $33,023; Despatch-Pittsford road, Monroe county, Monroe Road Co., Pittsford, $12,549; Tully Road, Onondaga county, F. J. Rockwood, Rochester, $36,646; Hilton-Bartletts Corners road, Monroe county, John Boylin, Bernards, $7,778; Mendon-Pittsford road, Monroe county, Mosier & Summers, Buffalo, $51,621; Troy-Speigletown road, Rensselaer county, T. H. Karr, Troy, $14,244; Schodack Center-Nassau road, Rensselaer county, Rockefeller Bros., Brooklyn, $49,895; Johnstown-Broadalbin road, Fulton county, DeGraff & Hogeboom, Bloomington, $41,677; Willetts-Weitbury Pond road, Nassau county, Long Island Construction Co., Long Island City, $63,189; Ely road, Onondaga county, F. A. Bortsch, Rochester, $15,564; Fabius road, Onondaga county, Jos. McCormick, Jr., Providence, R. I., $41,525. Contracts for constructing State roads were awarded Nov. 14 as follows: Sidney—Unadilla road in Otsego county, to John Harrigan, of New York City, for $35,541; North Tonawanda — Shawnee road, Niagara county, Bellow & Merritt Co., Tuckahoe, $38,706; Dansville—Mt. Morris, Section 1, Livingston county, Greece Construction Co., Rochester, $56,945; Whitehall—Fort Ann road, Washington county, Putnam & Hare, New York City, $31,609; Grand Central ave., Section 2, Chemung county, Casey & Murray, Rochester, $14,112; Potsdam—Parishville, Section 1, St. Lawrence county, Spuyten Duyvil Construction Co., New York City, $36,323; North Creek—County line, Warren county, Shanley & Morrissey Co., New York City, $28,104; Cortland—Truxton and Cuyler, Cortland county, Chambers & Grady, Rochester, $47,877; Delhi — Bloomville, Delaware county, John Harrigan, New York City, $55,635; Clarence Center road, Erie county, Joseph Dunfree, Syracuse, $59,002; Bath—Savona road, Steuben county, Stewart-Kerbaugh & Shanley Co., New York City, $12,566; Cooperstown—Threemile Point road, Otsego county, Malley & Davis, Schenectady, $31,430; South Schenectady — Mariaville road, Schenectady county, Malloy & Davis, Schenectady, $64,226; Huntington—Amity road, Suffolk county, Henry J. Mullen, Jamaica, $87,376; Jeffersonville—Kenoza Lake, Fosterdale road, Sullivan county, Bellow & Merritt, Tuckahoe, $49,903; Greenville—Coxsackie road, Greene county, Thomas O'Hern, Yonkers, $36,825.

SEWERS.

CONTEMPLATED WORK.

West Allis, Wis.—A sewerage system with a septic tank is contemplated.

Ladysmith, B. C.—Will soon vote on the issue of bonds for sewer purposes.

Lexington, Ky.—Voted to issue bonds for the construction of sewers.

Franklin, Ky.—Voted to issue bonds for the construction of sewers.

Monson, Mass.—Surveys are being made preliminary to constructing a sewerage system.

Winchester, Va.—The question of constructing a sewerage system will be voted on in December.

Fond du Lac, Wis.—A modern sewerage system is contemplated on the west side of the river.

Goshen, Ind.—The citizens are discussing the question of constructing a new sewerage system.

Menominee, Mich.—Voted to issue $30,000 bonds for constructing sewers and street improvements.

Winnipeg, Man.—The construction of a sewer in Jubilee ave. at a cost of $23,000 is contemplated.

Winona, Minn.—The question of creating a third sewerage district is being discussed.

Willows, Cal.—Voted to issue $30,000

bonds for constructing a sewerage system. E. M. Garrison, town clk.

North Yakima, Wash.—City council has decided to construct a 2,500-ft. extension of the trunk sewer line.

Kenosha, Wis.—The construction of a trunk sewer through the southern part of the city is contemplated.

Jackson, Mich.—Voted to issue $40,000 bonds for the completion of the Harmon drain trunk sewer.

Cherokee, Okla.—Voted to issue $65,000 bonds for the construction of a water works and sewerage system.

Lincoln, Neb.—The estimated cost of reconstructing a storm sewer on N st. is $15,500. Wm. Grant, cy. engr.

Sharon, Pa.—Special.—Horace W. Davis advises us that he is in the market for machinery and tools for sewage disposal.

Grand Forks, N. D.—The construction of about 60 blocks of sewers in DeMers ave. has been decided upon by council.

Rochester, Minn.—Plans for a sewerage and water works system will be made by W. C. Fraser, cons. engr., of this city.

Imperial, Cal.—Special.—John T. Rice, cy. engr., is preparing plans and estimates for a sewerage system and septic tank.

Deposit, N. Y.—The construction of a sewerage system and sewage disposal plant is under discussion. Calvin Onderdonk, vil. clk.

South Sharon, Pa.—This town has decided to construct a sewage disposal plant in compliance with the demands of the State Board of Health.

Belleville, Ill.—Plans have been prepared for constructing 5,500 ft. of 12 to 24-in. vitrified clay pipe sewer. Fred Deutschmann, cy. engr.

Wampsville, N. Y.—Plans are being prepared for the disposal of sewage of the county buildings here. J. A. Loyster, chm. bldg. com., Cazenovia.

New York City.—A petition is being circulated by the property owners of Broadway-Flushing to construct a sewer and appurtenances in 26th st.

York, Pa.—Will vote in February on the question of issuing bonds for the completion of the sewerage system and the construction of a sewage disposal plant.

Chicago, Ill.—The engineering committee of the drainage board authorized, Nov. 17, the erection of an experimental sewage purification plant at 92nd st. and the Calumet river.

Newport, Ark.—Special.—This city has postponed until Jan., 1909, the letting of a contract for constructing sewers, including deep well and pumping plant. Lund & Hill, cons. engrs., Little Rock.

Washington, D. C.—The district commissioners have authorized the extension of the trunk sewer in Arkansas ave. at a cost of $7,000 and a sewer in 13th st. N.E. and Hamlin st., at a cost of $4,000.

Pullman, Wash.—The improvement of the sewerage system next year by the enlargement of ¾ mile of the trunk sewer from 8 to 18 inches and 2 miles of laterals from 4 to 6 inches, the trunk sewer to discharge into a septic tank is contemplated.

St. Paul, Minn.—The construction of a sewer in Prior ave. at a cost of $75,000 is recommended by the city engineer. The construction of the Portland-Aldine sewer system, 1½ miles long, and a sewer in Randolph st. is contemplated.

New York City.—A public hearing will be held Dec. 9 by the New York Harbor Line Board, on application of the Passaic Valley Sewerage Commission, for consent of the War Department to construct and maintain an outlet sewer beneath the waters of New York and Newark Bays.

CONTRACTS TO BE LET.

Dec. 2 for constructing a sewer in E. Dec. 2 for constructing a swer in E. 98th st. Bird S. Coler, pres. boro.

Estherville, Ia.—Bids are asked until Dec. 22 for constructing a ditch for joint drainage district No. 42, Emmet and Palo Alto counties. S. R. Stedman, co. audt.

Des Moines, Ia.—Sealed bids are asked until Dec. 15 for constructing the Louisa-Des Moines drainage district No. 4. Harman Eng. Co., engrs., 120 Fredonia ave., Peoria, Ill.

Muskegon, Mich.—Sealed bids are asked until Dec. 7 for constructing a sewer in Clinton st. and a drainage sewer to carry off the surface water in an alley. B. H. Tellman, cy. recdr.

Toronto, Ont.—Bids are asked until Dec. 15 for constructing 1,971 ft. of 7-ft. 1-in., 2,417 ft. of 7-ft. 9-in., 1,557 ft. 8-ft. and 440 ft. 8-ft. 6-in. circular sewer, together with manholes, connections, etc. Joseph Oliver, mayor.

Hobart, Okla.—Bids are asked until Dec. 8 for constructing an extension to the sanitary sewer system, requiring 910 ft. of 12-in. concrete or vitrified clay pipe, 1,900 ft. of 10-in. concrete or vitrified clay pipe, 13,080 ft. of 8-in. concrete or vitrified clay pipe, 31 manholes, 6 flush tanks. A. F. Hooper, mayor; O. E. Noble, cy. engr.

New York City.—Bids are asked until Dec. 2 for constructing an iron and tile trunk sewer and branch tile sewers throughout the grounds of the Riverside Hospital, North Brother Island. Thos. Darlington, M. D., pres. Bd. of Health.

CONTRACTS AWARDED.

Springfield, Mo.—Will F. Plummer was awarded the contract for constructing sewers in sewer district No. 23.

Springfield, O.—The contract for constructing sewers was awarded to Gould & Wright for $16,631.

Silvis, Ill.—The contract for constructing an outlet sewer was awarded to C. Berglund of Moline for $12,550.

Columbus, O.—McCracken & Co. secured the contract for constructing a storm sewer in Scott st. for $17,779.

De Pere, Wis.—The contract for constructing the west side sewer was awarded to Thos. Connolly for $3,000.

Oconomowoc, Wis.—The contract for constructing a sewerage system was awarded to C. J. Crillay, of Milwaukee, for $22,398.71.

St. Paul, Minn.—The contract for constructing a sewer in Delaware ave. was awarded, Nov. 5, to D. W. Moore for $11,397.

Jackson, Tenn.—The contract for constructing sewers and cement walks was awarded to the West Construction Co. for $23,564.04.

Elizabeth, N. J.—Wm. J. McCloud & Co. secured the contract, Nov. 2, for constructing an intercepting sewer for $173,946.

Schenectady, N. Y.—The contract for constructing a surface water sewer in Rugby road was awarded to Kellam & Shaffer.

Long Island City, L. I., N. Y.—The tract for constructing a sewer in 17th ave. was awarded to the Goremannen Co. for $10,150.

Selma, Ala.—The Crockett Paving Co., of Birmingham, was awarded the contract for constructing 2½ miles of main sewer in North Selma.

De Pere, Wis.—Thos. Conley was

awarded the contract for constructing a sewer in the west side at $1.10 a lin. ft. and $25 per manhole.

Wyoming, O.—The contract for constructing a sewage disposal plant and 22,569 ft. of sewers was awarded, Nov. 10, to Thomas P. Strack for $32,000.

Louisville, Ky.—The contract for constructing Section E of the southern outfall sewer was awarded to the Ferro Concrete & Construction Co., of Cincinnati, for $110,000.

San Pedro, Cal.—The contract for constructing an outfall sewer in the northern section of the city, 1,400 ft. long, was awarded to E. R. Werdin, of Los Angeles, for $4,031.

Marshall, Ill.—The Mercantile Bridge & Concrete Tile Co., of Paris, Ill., was awarded the contract for constructing about 2 miles of reinforced concrete and vitrified pipe sewers for $15,271.

Syracuse, N. Y.—The contract for constructing a pipe sewer was awarded to Chas. T. Hockway for $3,831, and for a pipe sewer in Avery ave., Bryant st. and Whittier ave. to Joseph Swift for $4,603.

Spokane, Wash.—The contract for constructing a sub-trunk sewer in the First ward was awarded to Lang & Smith for $21,390. Other contracts awarded were as follows: In alley, James C. Broad, $1,109; 2nd ave., Thos. Malony, $4,232; 17th ave., Thos. Malony.

Salt Lake City, Utah.—Special.—Sewer contracts were awarded Nov. 6 as follows: Sewer extension No. 211, J. D. Hanley, city, $768.46; No. 213, J. D. Hanley, $923.70. The contract for constructing a brick building for suction gas producer plant at the main intercepting sewer pumping station was awarded to Louis A. Geisler for $3,425.

Baltimore, Md.—Contracts for sewerage construction, aggregating $932,798.79, were awarded Oct. 24 as follows: Contract No. 30—Sewage disposal works—New York Contracting Co., of New York, $506,997.75; time for completing work, 500 days. Contract No. 31—West low level intercepter, section four, Metropolitan Contracting Co., of Baltimore, $49,-821; time for completing contract, 250 days. Contract No. 32—Force main sewer, Ryan & Reilly, of Philadelphia, $155,201.25; time for completing work, 275 days. Contract No. 33—Force main, the Warren F. Brenizer Co., of Baltimore; time for completing work, 250 days.

WATER WORKS.

Manila, P. I.—The new water works system, which has been in course of construction for three years, has been completed at a cost of $2,000,000. The water was turned into the mains Nov. 12.

Pekin, Ill.—Jas. F. St. Cerny, cy. atty., delivered a written opinion recently to the effect that the city is incapable of entering into a contract or lease of a water works plant because it has already exceeded the constitutional limit of bonded indebtedness.

Connersville, Ind.—Sealed bids are asked until Jan. 12 for the construction of additions and improvements to the city water works system, requiring a source for a pure water supply, a new pumping station, machinery, coal bins, side tracks, new pipe lines, etc., for a period of not less than 10 nor more than 25-yrs. Karl L. Hanson, cy. engr.

CONTEMPLATED WORK.

Renton, Wash.—Voted to construct a new water works system.

Granite, Okla.—Voted to issue bonds for constructing water works.

Pella, Ia.—Will vote on the construction of a water works system.

Auburn, N. Y.—A filtration plant is under consideration, according to press reports.

Parsons, W. Va.—Voted to issue bonds for constructing a water works system.

Carsonville, Mich.—Voted to issue bonds for constructing a water works system.

Baltimore, Md.—Voted to issue bonds for extending the proposed conduit system.

Grandville, Mich.—The construction of a water works system is contemplated.

Shirley, Ind.—The question of constructing a water works system will be voted on.

Teague, Tex.—Estimates are being prepared for constructing a water works system.

Seneca, S. C.—Voted to issue bonds for constructing a water works system.

Colfax, Ill.—The question of constructing a water works system is being urged.

Council Bluffs, Ia.—Voted to issue bonds to construct a municipal water works system.

Carlisle, Ky.—The Commercial Club will take up the question of securing a water works system.

Wallingford, Conn.—Voted to issue bonds for the extension of the water mains to Yalesville.

Shelburne Falls, Mass.—The question of securing a gravity water supply is under consideration.

International Falls, Minn.—Plans for a water works system will be made by W. C. Fraser, of Rochester.

Sebree, Ky.—This city voted to issue bonds for building a water works system. C. H. Ramsey, mayor.

Apple Creek, O.—The construction of a water works system is contemplated. Tilden Landell, vil. clk.

Hamlet, N. C.—The Hamlet Water Works Co. will extend the water mains and enlarge and improve the plant.

Waterbury, Conn.—The construction of a water main in Baldwin st. has been recommended. R. A. Cairns, cy. engr.

Goshen, Ind.—The water works committee has decided to recommend the purchase of an electric pump and four new filters.

Wichita, Kas.—Voted to issue bonds for the construction of a municipal water works system. R. N. Dorr, cy. clk.

Bloomington, Ind.—A report has been submitted by Prof. J. W. Beeda on the inadequate water supply of this city.

Waverly, Ia.—Voted to issue bonds to rebuild the electric light and water works plants, which were destroyed by fire.

Kansas City, Mo.—Plans and specifications are to be made for installing a pump at the Turkey Creek pumping station.

Covington, La.—Special.—Edward H. Richard, cy. atty., advises us that he is in the market for water works and ice plants.

Aberdeen, Wash.—Will vote soon on the proposition of issuing bonds to extend the water mains and construct a reservoir.

San Francisco, Cal.—This city voted, Nov. 12, to issue $600,000 bonds for the purchase of the proposed site for a reservoir.

Newport, Ky.—Voted for water works improvements, to include the construction of a standpipe. W. L. Glazier, supt. w. w.

Adairsville, Ga.—The city council has decided to enlarge the municipal water works system by adding about 3,000 lin. ft. of 6-in. cast iron water pipe.

Murdo, S. D.—New bids will be asked, according to press reports, until Dec. 7 for a pumping station, distributing system and steel tank and tower. Cy. clk.

New York City.—The bd. of aldermen appropriated, Nov. 10, the sum of $1,800,000 for the installation of a high pressure water system in the district bounded by Houston st., East river, Bowery and James st.

Medford, Ore.—Special.—The citizens of this city have voted to authorize the purchase of a water right amounting to 7.5 cu. ft. per sec. from the Fish Lake Water Co. The water will be taken from the north fork of Little Butte Creek, a stream having a low water flow of 100 cu. ft. per second. The city pays $15,000 for the water right. W. J. Roberts, cons. engr., says the gravity pipe line will be 16-inch machine banded, stave pipe, 23.3 miles in length, having a capacity of 4,000,000 gallons a day. A 2,000,000-gallon distributing reservoir, 100 tons cast iron pipe and other appurtenances are included in a contract awarded to I. L. Hamilton for $239,100. Associated with Mr. Hamilton in the contract are C. D. Vincent, of San Francisco, and Shirley Baker, of the Redwood Mfg. Co., of San Francisco.

CONTRACTS TO BE LET.

Gridley, Cal.—Bids are asked until Dec. 14 for erecting a steel tank and tower. F. G. Moesch, cy. clk.

Eveleth, Minn.—Bids are asked until Dec. 15 for constructing a reservoir. Edw. P. Burch, engr., Minneapolis.

Meridian, Miss.—Bids are asked until Dec. 8 for constructing a reinforced concrete reservoir. W. w. comrs.

Daytona, Fla.—Bids are asked until Jan. 1 for constructing a water works system. D. D. and C. M. Rogers, engrs.

Grand Rapids, Mich.—Sealed bids are asked until Dec. 3 for furnishing 847 water meters. George C. Peirce, pres. B. P. W.

Augusta, Kas.—Bids are asked until Dec. 20 for constructing a water works system. Burns & McDonnell, engrs., Kansas City, Mo.

Amsterdam, N. Y.—Bids are asked until Dec. 8 for constructing a cast iron pipe line, Hans Creek conduit No. 2. Chas. C. Yund, pres. water comrs.

Covington, Ga.—Bids are asked until Dec. 2 for constructing a water works and sewerage system. C. C. Brooks, chm. comrs. w. w., etc.

Springfield, Mass.—Bids are asked until 2 p. m. Dec. 4 for constructing contract No. 5 of the Little river water supply system, which includes the Borden brook dam and reservoir. Bd. water comrs.

CONTRACTS AWARDED.

Sherman, N. Y.—The contract for constructing a water-works system was awarded to E. F. Benson & Co., of Falconer, for $15,377.

Wood River, Ore.—The contract for constructing a water-works and electric light system was awarded to F. H. Wheeler, for $19,550.

Gadsden, Ala.—The contract for the extension of the water works was awarded, Nov. 14, to the Corinth Engine & Boiler Works, of New Orleans.

Clarkston, Utah—The contract for constructing a water-works system was awarded to the Wheelwright Construction Co., of Ogden.

Milwaukee, Wis.—The contract for laying 6,000-ft. of 6 and 8-in. water mains in West Allis was awarded to George Zimmerman, of this city.

Clarksdale, Miss.—The contract for boring an artesian well to increase the water supply was awarded to Johnson & Fleming, of Memphis, Tenn.

Lima, O.—The contract for installing an air compressor at the water works was awarded to the Harris Air Lift Pump Co., of Indianapolis, Ind., for about $6,000.

Cincinnati, O.—The contract for cleaning a portion of the western water mains in this city was awarded, Nov. 11, to the Whitney Pipe Cleaning Co., for $4,816.50.

Boston, Mass.—The contract for building the pumping station at Gravelly Pond, Manchester, in connection with the additional water supply, has been awarded to George S. Sinnicks for $11,000.

New York City—The contract for furnishing and laying 16-mis. of 72-in. lock-bar steel pipe in Brooklyn was awarded to the T. A. Gillespie Co., of Pittsburg, for about $2,000,000.

Anadarko, Ok.—The contract for constructing a dam on the Washita river and installing water power, extending water, light and sewer systems and other improvements was awarded to the O'Neil Engineering Co., of Dallas, Tex., for about $85,000.

Los Angeles, Cal.—The contract for furnishing water pipe was awarded, Nov. 2, to Crane & Co., local agents for the American Cast Iron Pipe Co., as follows: 2,700 tons bell and spigot c. i. water pipe at $31.25 per ton, f. o. b. Los Angeles, and 51 tons 16-in. pipe at factory, $17.50 per ton.

St. Marys, Kas.—The contract for constructing a water-works and electric light plant was awarded to W. W. Cooks & Co., of Junction City, Kas., for $22,760. This firm was also awarded a contract for furnishing hydrants and valves, c. i. pipe and special castings for $8,578, and pumping machinery, engine, tower and tank.

BRIDGES.

Wichita, Kas.—Bids are asked until Dec. 5 for constructing pile bridges. Co. comrs.

Princeton, Ind.—Bids are asked until Dec. 8 for constructing 33 bridges. Harry R. Embree, co. audt.

Valparaiso, Ind.—Bids are asked until Dec. 7 for constructing steel bridges. G. F. Stinchgeld, co. surv.

Bowling Green, Va.—Plans have been approved for constructing a steel bridge across North Anna River. Co. comrs.

Grenada, Miss.—Bids are asked until Dec. 7 for constructing an iron bridge across Bogue creek. Co. comrs.

Rensselaer, Ind.—Bids are asked until Jan. 12 for constructing a bridge over the Kanku river. J. H. Leatherman, co. audt.

Coshocton, O.—Plans have been prepared and bids will be asked for constructing 2 steel or reinforced concrete bridges.

Green Bay, Wis.—Bids are asked until Dec. 14 for constructing a bridge over Fox river at Walnut st. W. W. Reed, cy. engr.

Barrington, R. I.—The town council has under consideration the construction of a

riprap wall and repairs to the Barrington river bridge.

Milwaukee, Wis.—Bids are asked until Dec. 4 for constructing an open draw bridge at E. Water st. Chas. J. Poetsch, chmn. B. P. W.

Plattsburg, N. Y.—Bids will be asked soon for constructing a new bridge over the Saranac river at Caroline st. Ralph L. Signor, vil. engr.

Fairbury, Neb.—Bids are asked until Jan. 1 for constructing the bridges required in this county during the year. F. A. Houston, co. clk.

Wilkes-Barre, Pa.—The Grand Jury has recommended the construction of 27 new bridges, of which 14 will be stone arch bridges, 8 concrete bridges and 5 iron bridges.

Evanston, Ill.—Bids are asked until Dec. 2 for constructing the superstructure of the Chicago, Milwaukee & St. Paul Ry. bridge. I. J. Ryan, clk. bd. trustees of Sanitary Dist.

Kansas City, Mo.—Bids are asked until Dec. 7 for the manufacture and erection of a steel superstructure and concrete footings of a viaduct on Main st. Commercial Improvement Co., 220 Dwight bldg.

Columbus, O.—Bids are asked until Dec. 16 for constructing a steel superstructure of a viaduct over the tracks of the Hocking Valley & Toledo and Ohio Central railways at Mount st. Bids will also be received for furnishing and constructing the masonry approaches to the structure. B. P. S.

STREET LIGHTING.

Brattleboro, Vt.—The construction of a municipal electric light plant is contemplated.

Madison, Wis.—The question of installing a plant to light the city buildings is under consideration.

Hartford City, Ind.—The construction of a gas plant here is contemplated by Charles Henry, of Marion.

North Adams, Mass.—The North Adams Gas Light Co. is planning to construct an electric light plant. H. T. Cady, prest.

Cincinnati, O.—Bids are asked until Dec. 11 for constructing a power house at Dam. No. 37, Ohio river. Col. Wm. T. Rossell, corps engrs.

Danville, N. Y.—The stockholders of the Danville Electric Co. have decided to establish an electric light plant. C. T. Meadows, mgr.

Goshen, Ind.—Bids are asked until Dec. 10 for installing an acetylene plant at the county infirmary. D. O. Batchelor, co. audt.

Geneva, N. Y.—H. B. Sweet has submitted a report to the special electric committee on the probable cost of a municipal electric light plant.

Hartford, Conn.—Bids are asked until Jan. 4 for the public lighting of the city for 1 and 5-yrs. Jas. P. Berry, secy. bd. contr. & sup.

Fort Sam Houston, Tex.—Bids are asked until Dec. 2 for the construction and extension to the eelctric light lines and additional street lights here. L. J. Fleming, contr. Q. M.

Niagara Falls, N. Y.—Bids are asked until Dec. 4 for constructing electric heating and lighting for shaft and tunnel and inclined foot path. Edward H. Perry, supt. state reservation.

Newcastle, Ind.—Ambrose Petry, of Detroit, and associates H. L. Olds and M. O. Straight, who are interested in the Light, Heat & Power Co. of this city, contemplate the establishment of an artificial fuel gas plant in this city.

Boston, Mass.—Guy C. Emerson, supt. of sts., 47 City Hall, invites parties having street lighting apparatus adapted to systems other than the present system of low-pressure gas manties to demonstrate, if they so desire, during the continuance of the present contract for street lighting, with a view to the improvement of the present system upon the expiration of the present contract on Sept. 15, 1909.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Kansas City, Mo.—The city comptroller has recommended the construction of a garbage disposal plant.

Willimantic, Conn.—The contract for the removal of garbage has been awarded to Joseph Morris for a period of 2-yrs.

Covington, Ky.—The construction of an additional garbage furnace has been recommended by Ellsworth Woods, supt. pub. wks.

Milwaukee, Wis.—Bids will be asked in January for the construction of the proposed garbage crematory. Chas. J. Poetsch, cy. engr.

Reading, Pa.—The contract for the collection, removal and disposal of garbage, offal and animals was awarded to Harry J. Adams for 5-yrs. at $1.94 a ton.

PARKS.

Independence, Mo.—Council has under consideration the issue of $25,000 city park bonds. Llewelyn Jones.

Tacoma, Wash.—The park board has asked for a levy of 1½ mills for park purposes during the next year.

Monroe, Wis.—An offer of 20 acres of land to be maintained and used as a public park has been made to this city.

Kansas City, Mo.—The park board has recommended an issue of $600,000 bonds for park purposes. Franklin Haudson, chmn. bd.

Hamilton, O.—J. E. Freudenberger, of Dayton, has been engaged to prepare plans for the improvement of a levee park along the banks of the Maumee river.

FIRE APPARATUS.

Big Fork, Minn.—The purchase of a hose cart is urged.

Hurley, S. D.—The fire department contemplates the purchase of hose and a hose cart.

Chillicothe, O.—Special. Walace D. Yaple, mayor, advises us that he desires plans for a fire engine house.

Grand Forks, N. D.—Bids are asked until Dec. 7 for furnishing 1,000-ft, of 2½-in. fire hose. W. H. Alexander, cy. audt.

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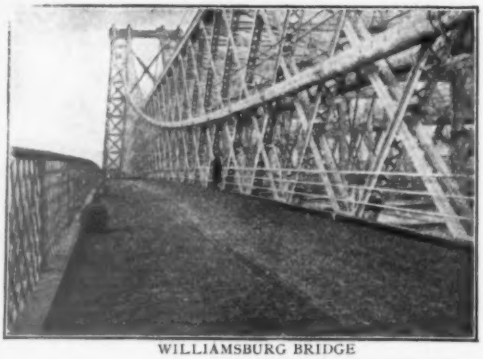

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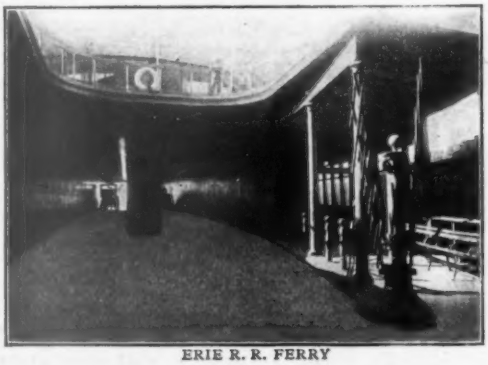

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Adjustable Steel Centering Co., Fond du Lac, Wisc.

Analyses.
Meade Testing Laboratories, Nazareth, Pa.
Osborn Engineering o., Cleveland, Ohio.
Henry S. Spackman Engineering Co., Philadelphia.

Architects.
Clifford A. Tinker, Westfield, Mass.

Artificial Stone Sidewalks.
R. S. Blome Co., Chicago, Ill.
Warren Brothers Company, Boston, Mass.
Warren Construction Co., Portland, Ore.

Asphalt.
American Asphaltum and Rubber Co., Chicago, Ill.
Andrews Asphalt Paving Co., Hamilton, O.
H. & A. B. Aveline Sicilian Rock Asphalt Co., Catania, Italy (postage 5 cents.)
A. L. Barber Asphalt Co., New York City.
Gabriel & Schall, New York City.
Globe Asphalt Co., Pittsburg, Pa.
Impervious Product Co., Baltimore, Md.
F. J. Lewis Mfg. Co., Moline, Ill.
The Sicilian Asphalt Paving Co., New York.
Standard Asphalt & Rubber Co., Chicago, Ill.
Uvalde Asphalt Co., New York City.
Warren Asphalt Paving Co., Cambridge, Mass.

Asphalt Filler.
Impervious Product Co., Baltimore, Md.
Standard Asphalt & Rubber Co., Chicago, Ill.

Asphalt (Brunswick) Importers.
Gabriel & Schall, New York City.

Asphalt Floors.
American Asphaltum & Rubber Co., Chicago, Ill.
R. S. Blome Co., Chicago, Ill.
Standard Asphalt & Rubber Co., Chicago, Ill.

Asphalt Machinery.
Atlas Dryer Co., Cleveland, O.
F. D. Cummer & Son Co., Cleveland, O.
East Iron & Machine Co., Lima, O.
Hetherington & Berner, Indianapolis, Ind.
Iroquois Iron Works, Buffalo, N. Y.
Warren Asphalt Paving Co., Cambridge, Mass.

Asphalt Pavements.
American Asphaltum & Rubber Co., Chicago, Ill.
Andrews Asphalt Paving Co., Hamilton, O.
A. L. Barber Asphalt Co., New York City.
Gilsonite Construction Co., St. Louis, Mo.
The Sicilian Asphalt Co., New York.
Standard Asphalt & Rubber Co., Chicago, Ill.
Warren Asphalt Paving Co., Cambridge, Mass.
Western Construction Co., Lafayette, Ind.

Asphalt Pavement and Filler.
Standard Asphalt & Rubber Co., Chicago, Ill.

Asphalt Plants.
Atlas Dryer Co., Cleveland, O.
The F. D. Cummer & Son Co., Cleveland, O.
East Iron & Machine Co., Lima, O.
Erie Machine Shop, Erie, Pa.
Hetherington & Berner, Indianapolis, Ind.
Iroquois Iron Works, Buffalo, N. Y.
Warren Asphalt Paving Co., Cambridge, Mass.

Asphalt Railroad Plants.
Atlas Dryer Co., Cleveland, O.
F. D. Cummer & Son Co., Cleveland, O.
East Iron & Machine Co., Lima, O.
Hetherington & Berner, Indianapolis, Ind.
Iroquois Iron Works, Buffalo, N. Y.
Warren Asphalt Cement Co., Cambridge, Mass.

Asphalt Sidewalks.
R. S. Blome Co., Chicago, Ill.
Sicilian Asphalt Paving Co., New York City.
Warren Bros. Co., Boston, Mass.

Asphalt Tools.
Contractors' Tool Company, Philadelphia, Pa.
Iroquois Iron Works, Buffalo, N. Y.
Warren Asphalt Paving Co., Cambridge, Mass.

Auditing.
Marwick, Mitchell & Co., Chicago, Ill.
Adolphe Rafter, New York City.

Ball Mills.
Krupp (Thos. Prosser & Son, New York City.)
F. L. Smith & Co., New York City.

Bituminous Macadam Materials.
F. J. Lewis Mfg. Co., Moline, Ill.

Bitulithic Materials.
F. J. Lewis Mfg. Co., Moline, Ill.

Bitulithic Pavements.
Hoosier Construction Co., Indianapolis, Ind.
Warren Bros. Co., Boston, Mass.

Bituminous Macadam.
Warren Bros. Co., Boston, Mass.

Bolting Screens.
Jeffrey Mfg. Co., Columbus, O.

Bonds.
Orin D. Walker, Indianapolis, Ind.

Brick Dies.
Portsmouth Machine & Casting Co., Portsmouth, O.

Brick Dryers.
Atlas Dryer Co., Cleveland, O.

Brick Clamps.
Duplex Foundry and Mfg. Co., Cleveland, O.

Brick Machinery.
A. J. Ralph & Co., Indianapolis, Ind.

Brick Testing Machinery.
Tinius Olsen & Co., Philadelphia, Pa.

Bridge Coatings.
American Asphaltum and Rubber Co., Chicago, Ill.
Standard Asphalt & Rubber Co., Chicago, Ill.

Bridges.
R. S. Blome Co., Chicago, Ill.
Concrete Steel Engineering Co., New York City.
Geo. W. Fife, Indianapolis, Ind.
Osborn Engineering Co., Cleveland, O.

Builders' Supplies.
Ohio Quarries Co., Cleveland, O.
A. & S. Wilson Co., Pittsburg, Pa.

Cast Iron Culverts.
Feltz & East, Lima, O.

Catch Basin Manufacturers.
Reinforced Concrete Pipe Co., Jackson, Mich.

Cement.
Alpha Portland Cement Co., Alpha, N. J.
Alsen's Am. Portland Cement Co., New York City.
Art Portland Cement Co., Kimmell, Ind.
Atlas Portland Cement Co., New York City.
J. E. Bartlett Co., Jackson, Mich.
Central Portland Cement Co., Kansas City, Mo.
Chicago Portland Cement Co., Chicago, Ill.
Dexter Portland Cement Co., Philadelphia, Pa.
French, Samuel H. & Co., Philadelphia, Pa.
Gabriel & Schall, New York City.
Gill & Greenen, Indianapolis, Ind.
Granite City Lime & Cement Co., Granite City, Ill.
W. G. Hartranft Cement Co., Philadelphia, Pa.
F. B. Holmes & Co., Detroit, Mich.
Kansas Portland Cement Co., Iola, Kan.
Kosmos Portland Cement Co., Louisville, Ky.
H. H. Lamb, Indianapolis, Ind.
Lehigh Portland Cement Co., Cleveland, O.
Lesley & Trinkle, Philadelphia, Pa.
Marquette Cement Mfg. Co., Chicago, Ill.
Meachan & Wright, Chicago, Ill.
Northampton Portland Cement Co., N. Y. City.
Omega Portland Cement Co., Jonesville, Mich.
Peninsular Portland Cement Co., Jackson, Mich.
St. Louis Portland Cement Co., St. Louis, Mo.
Schaeffer & Gengnagel, Dayton, O.
Universal Portland Cement Co., Chicago, Ill.
U. S. Cement Co., Bedford, Ind.
Charles Warner Co., Wilmington, Del.
Western States Port. Cem. Co., Independence, Kan.
Wolverine Portland Cement Co., Coldwater, Mich.
Wyandotte Portland Cement Co., Wyandotte, Mich.
York Portland Cement Co., Portsmouth, O.

Cement Brick Machinery.
A. J. Ralph & Co., Indianapolis, Ind.
Waterloo Cement Machinery Co., Waterloo, Iowa.

Cement Machinery.
Atlas Dryer Co., Cleveland, O.
Chambers Bros. Co., Philadelphia, Pa.
Geo. V. Cresson Co., Philadelphia, Pa.
F. D. Cummer & Son Co., Cleveland, O.
Jeffrey Mfg. Co., Columbus, O.
Krupp (Thos. Prosser & Son, New York City.
Link Belt Engineering Co., Philadelphia, Pa.

BUSINESS DIRECTORY—CONTINUED.

Ruggles-Coles Engineering Co., New York City.
F. L. Smidth & Co., New York.

Cement Molds.
Waterloo Cement Machinery Co., Waterloo, Iowa.

Cement Paving.
R. S. Blome Co., Chicago, Ill.
Gilsonite Construction Co., St. Louis, Mo.
J. E. Salfisberg & Co., Aurora, Ill.
John A. Spencer, Grinnell, Ia.

Cement Pipes Molding Press.
Reinforced Concrete Pipe Co., Jackson, Mich.
F. L. Smidth & Co., New York City.

Cement Plant Designers.
Osborn Engineering Co., Cleveland, O.
F. L. Smidth & Co., New York City.
Henry S. Spackman Engineering Co., Philadelphia, Pa.

Cement Posts.
Waterloo Cement Machinery Co., Waterloo, Iowa.
The Waterville Stone Co., Toledo, O.

Cement Sewer Pipe.
Reinforced Concrete Pipe Co., Jackson, Mich.

Cement Sewer Pipe Machinery.
Reinforced Concrete Pipe Co., Jackson, Mich.
F. L. Smidth & Co., New York City.
Waterloo Cement Machinery Co., Waterloo, Iowa.

Cement, Tar and Pitch.
F. J. Lewis Mfg. Co., Moline, Ill.

Cement Testing.
Lehigh Valley Testing Laboratory, Allentown, Pa.
Meade Testing Laboratories, Nazareth, Pa.
Osborn Engineering Co., Cleveland, O.

Cement Testing Machinery.
Tinius Olsen & Co., Philadelphia, Pa.

Cement Tile Machinery.
Waterloo Cement Machinery Co., Waterloo, Iowa.

Cement Tools.
Adjustable Name Stamp Co., Clinton, Wis.
Contractors' Tool Co., Philadelphia, Pa.
Waterloo Cement Machinery Co., Waterloo, Iowa.

Cement Weighing Machines.
F. L. Smidth & Co., New York City.

Centering.
Adjustable Steel Centering Co., Fond du Lac, Wis.

Chemical Tests.
R. W. Hunt & Co., Chicago, Ill.
Lehigh Valley Testing Laboratory, Allentown, Pa.
Meade Testing Laboratories, Nazareth, Pa.
Osborn Engineering Co., Cleveland, O.
Henry S. Spackman Engineering Co., Philadelphia, Pa.
John C. Sparks, New York City.

Chemists—Cement.
Lehigh Valley Testing Laboratory, Allentown, Pa.
Meade Testing Laboratories, Nazareth, Pa.
Henry S. Spackman Engineering Co., Philadelphia, Pa.

Chemists—Consulting.
Meade Testing Laboratories, Nazareth, Pa.
Henry S. Spackman Engineering Co., Philadelphia, Pa.
John C. Sparks, New York City.

Civil Engineers.
J. Walter Ackerman, Auburn, N. Y.
C. R. Allen & Son, Ottumwa, Ia.
The Brotherton Co., Escanaba, Mich.
C. C. Brown, Indianapolis, Ind.
Mason L. Brown, Detroit, Mich.
B. H. Colby, St. Louis, Mo.
Charles Cottingham, Danville, Ind.
Cummins & Swanitz, Chicago, Ill.
Douglas & McKnight, Pittsburg, Pa.
Everett J. Felker, Brooks, Me.
P. W. Henry, New York City.
Hering & Fuller, New York, N. Y.
J. W. Howard, New York City.
R. W. Hunt & Co., Chicago, Ill.
E. B. Lynn Engineering Co., Cincinnati, O.
Harry J MacDargh, Dayton, O.
J. J. McVean, Grand Rapids, Mich.
Wm. D. Marks, New York City.
Dabney H. Maury, Peoria, Ill.
John Wharton Maxcy, Houston, Texas.
Frank D. Moses, Trenton, N. J.
Osborn Engineering Co., Cleveland, O.
F. A. Pease Engineering Co., Cleveland, O.
Alexander Potter, New York City.
Henry S. Spackman Engineering Co., Philadelphia, Pa.
A. D. Thompson, Peoria, Ill.
Clifford A. Tinker, Westfield, Mass.
M. Tschirgi & Sons, Dubuque, Ia.
F. M. Turner, Dayton, O.
Wise & Watson, Passaic, N. J.

Clay-Working Machinery.
Atlas Dryer Co., Cleveland, O.
Chambers Bros. Co., Philadelphia, Pa.

Clay Products.
Lewis McNutt, Brazil, Ind.
Shawmut Mining Co., Shawmut, Pa.

Coal and Coke.
Schaeffer & Gengnagle, Dayton, O.

Coal Tar.
F. J. Lewis Mfg. Co., Moline, Ill.
Nashville Roofing & Paving Co., Nashville, Tenn.
Warren Bros. Co., Boston, Mass.

Combined Curb and Gutter.
Rudolph S. Blome Co., Chicago, Ill.
Concrete Edge Protector Co., Detroit, Mich.
Steel Protected Concrete Co., Philadelphia, Pa.
Warren Bros. Co., Boston, Mass.

Concrete Blocks.
Century Cement Machine Co., Rochester, N. Y.

Concrete Construction Machinery.
Century Cement Machine Co., Rochester, N. Y.
Eureka Machine Co., Jackson, Mich.
L. T. McFarland, Van Wert, O.
Waterloo Cement Machinery Co., Waterloo, Iowa.

Concrete Edge Protector.
Concrete Edge Protector Co., Detroit, Mich.

Concrete Mixers.
Chambers Bros. Co., Philadelphia, Pa.
Eureka Machine Co., Jackson, Mich.
Jeffrey Mfg. Co., Columbus, O.
Waterloo Cement Machinery Co., Waterloo, Iowa.

Concrete Steel Arch Bridges.
Concrete Steel Engineering Co., New York City.
Osborn Engineering Co., Cleveland, O.

Concrete Work.
T. J. Backus Construction Co., Dayton, O.
Rudolph S. Blome Co., Chicago, Ill.
Central Paving Co., Chicago, Ill.
Geo. W. Clark, Wausau, Wis.
Concrete Edge Protector Co., Detroit, Mich.
Geo. W. Fife, Indianapolis, Ind.
L. T. McFarland, Van Wert, O.
J. E. Salfisberg & Co., Aurora, Ill
Sanitary Sewer Construction Co., Jackson, Mich.
John A. Spencer, Grinnell, Ia.
Clifford A. Tinker, Westfield, Mass.
Warren Bros. Co., Boston, Mass.

Consulting Engineers.
J. Walter Ackerman, Auburn, N. Y.
C. R. Allen & Son, Ottumwa, Ia.
Cummins & Swanitz, Chicago, Ill.
Dow & Smith, New York City.
Everett J. Felker, Brooks, Me.
P. W. Henry, New York City.
H. Whitford Jones, Cleveland, O.
E. B. Lynn Engineering Co., Cincinnati, O.
Harry J. MacDargh, Dayton, O.
J. J. McVean, Grand Rapids, Mich.
F. R. Meier, New York City.
New York Sewage Disposal Co., New York City.
Osborn Engineering Co., Cleveland, O.
F. A. Pease Engineering Co., Cleveland, O.
Alexander Potter, New York City
Power Specialty Co., New York City.
John C. Sparks, New York City.
A. D. Thompson, Peoria, Ill.
M. Tschirgi & Sons, Dubuque, Ia.
F. M. Turner, Dayton, O.
John Wharton Maxcy,, Houston, Tex.

Consulting Forester.
F. R. Meier, New York City.

BUSINESS DIRECTORY—CONTINUED.

Contractors.
Andrews Asphalt Paving Co., Hamilton, O.
T. J. Backus Construction Co., Dayton, O.
Jas. H. Baker & Sons, Port Huron, Mich.
Rudolph S. Blome Co., Chicago, Ill.
Central Paving Co., Chicago, Ill.
City Wastes Disposal Co., New York City.
Geo. W. Clark, Wausau, Wis.
J. E. Conley & Co., Dayton, O.
Geo. W. Fife, Indianapolis, Ind.
Glisonite Construction Co., St. Louis, Mo.
Hoosier Construction Co., Indianapolis, Ind.
Indiana Paving Brick & Block Co., Indianapolis, Ind.
L. T. McFarland, Van Wert, O.
J. E. Salfisberg & Co., Aurora, Ill.
Sanitary Sewer Construction Co., Jackson, Mich.
John A Spencer, Grinnell, Ia.
H. P. Streicher & Co., Toledo, O.
A. D. Thompson, Peoria, Ill.
M. Tschirgi & Sons, Dubuque, Ia.

Contractors' Supplies.
The F. Bissell Co., Toledo, O.
Ohio Quarries Co., Cleveland, O.
Portsmouth Machine & Casting Co., Portsmouth, O.
Standard Asphalt & Rubber Co., Chicago, Ill.
St. Louis Crushed Quartz Co., St. Louis, Mo.
Schaeffer & Gengnagle, Dayton, O.
J. H. Sullivan, Grand Rapids, Mich.
A. & S. Wilson, Pittsburg, Pa.

Contractors' Tools and Machinery.
Austin & Western Co., Ltd., Chicago, Ill.
The Conneaut Shovel Co., Conneaut, O.
Contractors' Tool Company, Philadelphia, Pa.
W. M. Toy & Co., Sidney, O.

Contractors' Wagons.
Studebaker Bros. Mfg. Co., South Bend, Ind.
Troy Wagon Works Co., Troy, O.
D. S. Watson, Canastota, N. Y.

Conveyors.
Browning Engineering Co., Cleveland, O.
Carson Trench Machine Co., Boston, Mass.
The Jeffrey Mfg. Co., Columbus, O.
Link Belt Engineering Co., Philadelphia, Pa.

Creosote.
F. J. Lewis Mfg. Co., Moline, Ill.
Republic Chemical & Creosoting Co., Indianapolis, Ind.
U. S. Wood Preserving Co., New York City.

Creosoted Wood Block.
Kettle River Quarries Co., Minneapolis, Minn.
Republic Chemical and Creosoting Co., Indianapolis, Ind.
U. S. Wood Preserving Co., New York City.

Crushers, Rock and Ore.
Austin & Western Co., Ltd., Chicago, Ill.
Geo. V. Cresson Co., Philadelphia, Pa.
Jeffrey Mfg. Co., Columbus, O.
Kent Mill Co., New York.

Crushed Stone.
Cleveland Stone Co., Chicago, Ill.
Flint Stone Co., Toledo, O.
Ohio Quarries Co., Cleveland, O.
St. Louis Crushed Quartz Co., St. Louis, Mo.

Culvert Pipe.
Canton Culvert Co., Canton, O.

Culvert Pipe, Cast Iron.
Feltz & East, Lima, O.

Culvert Pipe, Vitrified.
W. E. Dee Clay Mfg. Co., Chicago, Ill.
Buckeye Fire Clay Co., Uhrichville, O.
East Ohio Sewer Pipe Co., Irondale, O.
Michigan Sewer Pipe Co., Jackson, Mich.
H. Stevens' Sons Co., Macon, Ga.
Terre Haute Brick & Pipe Co., Terre Haute, Ind.

Culverts.
Canton Culvert Co., Canton, O.

Curbing.
R. S. Blome Co., Chicago, Ill.
Cleveland Stone Company, Cleveland, O.
Ft. Scott Stone & Constr. Co., Ft. Scott, Kan.
Ohio Quarries Co., Cleveland, O.
Steel Protected Concrete Co., Philadelphia, Pa.
Warren Bros. Co., Boston, Mass.

Dies.
Portsmouth Machine & Casting Co., Portsmouth, O.

Drain Tile.
Boone Brick, Tile & Paving Co., Boone, Ia.
W. E. Dee Clay Mfg. Co., Chicago, Ill.
Michigan Paving Brick Co., Saginaw, Mich.
Michigan Sewer Pipe Co., Jackson, Mich

Dryers.
Atlas Dryer Co., Cleveland, O.
F. D. Cummer & Son Co., Cleveland, O.
Iroquois Iron Works, Buffalo, N. Y.
Ruggles-Coles Engineering Co., New York City.

Dump Wagons.
Studebaker Bros. Mfg. Co., South Bend, Ind.
Troy Wagon Works Co., Troy, O.
Watson Wagon Co., Canastota, N. Y.

Duplex Brick Clamp.
Duplex Foundry and Mfg. Co., Cleveland, O.

Dust Layers.
Barrett Mfg. Co., New York City.

Dust Laying Compound.
Barrett Mfg. Co., New York City.
Impervious Product Co., Baltimore, Md.
F. J. Lewis Mfg. Co., Moline, Ill.
Standard Asphalt & Rubber Co., Chicago, Ill.

Egyptian Cement.
Bartlett & Co., Jackson, Mich.

Electrical Engineers.
H. Whitford Jones, Cleveland, O.
Osborn Engineering Co., Cleveland, O.
Reliance Engineering Co., Cincinnati, O.

Electrical Insulation.
Standard Asphalt & Rubber Co., Chicago, Ill.

Electrolytic Investigations.
Dabney H. Maury, Peoria, Ill.

Enameled Street Signs.
American Sign Co., Clyde, O.

Engineering Instruments.
Bausch-Lomb Optical Co., Rochester, N. Y.
Lufkin Rule Co., Saginaw, Mich.

Expansion Joints.
A. L. Holmes, Grand Rapids, Mich.
Standard Asphalt & Rubber Co., Chicago, Ill.

Expanded Metal Construction.
R. S. Blome Co., Chicago, Ill.
Expanded Metal & Corrugated Bar Co., St. Louis, Mo.

Filler.
American Asphaltum & Rubber Co., Chicago, Ill.
Barrett Manufacturing Co., New York City.
Impervious Product Co., Baltimore, Md.
F. J. Lewis Mfg. Co., Moline, Ill.
Standard Asphalt & Rubber Co., Chicago, Ill.
Sun Co., Philadelphia, Pa.

Filler Asphalt.
Standard Asphalt & Rubber Co., Chicago, Ill.

Fire Alarm Telegraph.
Gamewell Fire Alarm Telegraph Co., New York.

Fire Brick.
Clearfield Clay Working Co., Clearfield, Pa.
F. B. Holmes & Co., Detroit, Mich.
Michigan Paving Brick Co., Saginaw, Mich.
Michigan Sewer Pipe Co., Jackson, Mich.
H. Stevens' Sons Co., Macon, Ga.

Fire Clay Products.
Buckeye Fire Clay Co., Urichville, O.
Clearfield Clay Working Co., Clearfield, Pa.
W. E. Dee Clay Mfg. Co., Chicago, Ill.
F. B. Holmes & Co., Detroit, Mich.
Michigan Paving Brick Co., Saginaw, Mich.
Michigan Sewer Pipe Co., Jackson, Mich.
H. Stevens' Sons Co., Macon, Ga.

Fire Proof Construction.
R. S. Blome Co., Chicago, Ill.
Expanded Metal & Corrugated Bar Co., St. Louis, Mo.

Flint-Macadam Pavements.
Diamond Flint Co., Lafayette, Ind.

Floors.
Standard Asphalt & Rubber Co., Chicago, Ill.

Flue Liners.
W. E. Dee Clay Mfg. Co., Chicago, Ill.
Lewis McNutt, Brazil, Ind.

Flush Tanks.
Pacific Flush Tank Co., Chicago, Ill.

Forging-Steel.
Krupp (Thos. Prosser & Son, New York City).

Foundation, Concrete.
R. S. Blome Co., Chicago, Ill.

Garbage Disposal Plants.
City Wastes Disposal Co., New York City.
New York Sewage Disposal Co., New York City.
Power Specialty Co., New York City.

BUSINESS DIRECTORY—CONTINUED.

Gas Engineers.
Frank D. Moses, Trenton, N. J.
Wm. D. Marks, New York City.

Gas Lamps.
Royal Gas Light Co., Chicago, Ill.

Gas Pipe.
McWane Pipe Works, New York City.

Gas Works.
Frank D. Moses, Trenton, N. J.

Gasolene Engines.
Waterloo Cement Machinery Co., Waterloo, Iowa

GRANITOID CONCRETE BLOCK PAVEMT
Rudolph S. Blome Co., Chicago, Ill.

Gum Paints and Varnish.
Standard Asphalt & Rubber Co., Chicago, Ill.

Hoisters.
Carson Trench Machine Co., Boston, Mass.
Potter Mfg. Co., Indianapolis, Ind.

Hoisting Machinery.
Jeffrey Mfg. Co., Columbus, O.

Hollow Building Blocks.
Lewis McNutt, Brazil, Ind.

Hydraulic Cement.
Meacham & Wright, Chicago, Ill.

Hydrolene.
Sun Co., Philadelphia, Pa.

Impregnating Gums.
Standard Asphalt & Rubber Co., Chicago, Ill.

Inspection of Buildings.
Lehigh Valley Testing Laboratory, Allentown, Pa.
Osborn Engineering Co., Cleveland, O.

Inspection of Structural Materials.
Lehigh Valley Testing Laboratory, Allentown, Pa.
Osborn Engineering Co., Cleveland, O.
H. Whitford Jones, Cleveland, O.

Insulating Gums and Compounds.
Standard Asphalt & Rubber Co., Chicago, Ill.

Insulating Material.
Standard Asphalt & Rubber Co., Chicago, Ill.

Iron Paints.
Standard Asphalt & Rubber Co., Chicago, Ill.

Laboratory.
Lehigh Valley Testing Laboratory, Allentown, Pa.
Meade Testing Laboratories, Nazareth, Pa.
Osborn Engineering Co., Cleveland, O.
Henry S. Spackman Engineering Co., Philadelphia, Pa.

Landscape Engineers.
Mason L. Brown, Detroit, Mich.
F. R. Meier, New York City.

Lime Kilns.
F. L. Smidth & Co., New York City.

Macadamizing.
Granite City Lime & Cement Co., Granite City, Ill.
Warren Bros. Co., Boston, Mass.

Masons' Supplies.
J. E. Bartlett Co., Jackson, Mich.

Mastic.
Standard Asphalt & Rubber Co., Chicago, Ill.

Mastic Floors.
Standard Asphalt & Rubber Co., Chicago, Ill.

Mechanical Engineers.
Osborn Engineering Co., Cleveland, O.
Dabney H. Maury, Peoria, Ill.

Meters.
Buffalo Meter Co., Buffalo, N. Y.
Simplex Valve and Meter Co., Philadelphia, Pa.

Meter Boxes.
H. W. Clark, Mattoon, Ill.
Grand Rapids Meter Box Co., Grand Rapids, Mich.

Mineral Rubber.
American Asphaltum and Rubber Co., Chicago, Ill.
F. J. Lewis Mfg. Co., Moline, Ill.
Standard Asphalt & Rubber Co., Chicago, Ill.

Mineral Rubber Pipe Dip & Coatings.
Standard Asphalt & Rubber Co., Chicago, Ill.

Municipal Accounting.
Marwick, Mitchell & Co., Chicago, Ill.
Adolphe Rafter, New York City.

Municipal Lighting.
Barron-Collier Co., Memphis, Tenn.

Name Stamps.
Adjustable Name Stamp Co., Clinton, Wis.

Non-Staining Cement.
Art Portland Cement Co., Kimmell, Ind.

Paint and Varnish Gums.
Standard Asphalt & Rubber Co., Chicago, Ill.

Paints.
Standard Asphalt & Rubber Co., Chicago, Ill.

Paints, Iron.
Standard Asphalt & Rubber Co., Chicago, Ill.

Pans.
Portsmouth Machine & Casting Co., Portsmouth, O.

Pavements.
Rudolph S. Blome Co., Chicago, Ill.
Diamond Flint Co., Lafayette, Ind.
Standard Asphalt & Rubber Co., Chicago, Ill.

Paving Blocks.
Boone Brick, Tile & Paving Co., Boone, Ia.
Carlyle Paving Brick Co., Portsmouth, O.
Clinton Paving and Building Brick Company, Clinton, Ind.
Danville Brick Co., Danville, Ill.
Flint Brick & Coal Co., Des Moines, Ia.
Kettle River Quarries Co., Minneapolis, Minn.
Logan Brick Mfg. Co., Toledo, O.
McAvoy Vitrified Brick Co., Philadelphia, Pa.
Metropolitan Paving Brick Co., Canton, O.
Michigan Paving Brick Co., Saginaw, Mich.
Peebles Paving Brick Co., Portsmouth, O.
Purington Paving Brick Co., Galesburg, Ill.
Saginaw Paving Brick Co., Saginaw, E. S., Mich.
Springfield Paving Brick Co., Springfield, Ill.
The Wassal Brick Co., Glouster, O.
U. S. Wood Preserving Co., New York City.

Paving Brick.
Boone Brick, Tile & Paving Co., Boone, Ia.
Carlyle Paving Brick Co., Portsmouth, O.
Clearfield Clay Working Co., Clearfield, Pa.
Clinton Paving and Building Brick Co., Clinton, Ind.
Collinwood Shale Brick Co., Collinwood, O.
Danville Brick Co., Danville, Ill.
Flint Brick & Coal Co., Des Moines, Ia.
F. B. Holmes & Co., Detroit, Mich.
Kentucky Vitrified Brick Co., Louisville, Ky.
Logan Brick Mfg. Co., Toledo, O.
McAvoy Vitrified Brick Co., Philadelphia, Pa.
Metropolitan Paving Brick Co., Canton, O.
Michigan Paving Brick Co., Saginaw, Mich.
National Paving Brick Manufacturers Association, Terre Haute, Ind.
Peebles Paving Brick Co., Portsmouth, O.
Purington Paving Brick Co., Galesburg, Ill.
Saginaw Paving Brick Co., Saginaw, E. S., Mich.
Shawmut Mining Co., Shawmut, Pa.
Springfield Paving Brick Co., Springfield, Ill.
Terre Haute Brick and Pipe Co., Terre Haute, Ind.
Wabash Clay Mfg. Co., Veedersburg, Ind.
The Wassal Brick Co., Glouster, O.

Paving Brick Association.
National Paving Brick Manufacturers Association, Terre Haute, Ind.

Paving Brick Machinery.
Atlas Dryer Co., Cleveland, O.
Chambers Bros. Co., Philadelphia, Pa.

Paving Castings.
Portsmouth Machine & Casting Co., Portsmouth, O.

Paving, Cement Sidewalk.
R. S. Blome Co., Chicago, Ill.

Paving Contractors.
Andrews Asphalt Paving Co., Hamilton, O.
T. J. Backus Construction Co., Dayton, O.
Jas. H. Baker & Son, Port Huron, Mich.
Central Paving Co., Chicago, Ill.
Geo. W. Clark, Wausau, Wis.
Diamond Flint Co., Lafayette, Ind.
R. S. Blome Co., Chicago, Ill.
Gilsonite Construction Co., St. Louis, Mo.
Hoosier Construction Co., Indianapolis, Ind.
Indiana Paving Brick and Block Co., Indianapolis, Ind
Sicilian Asphalt Co., New York City.
H. P. Streicher & Co., Toledo, O.
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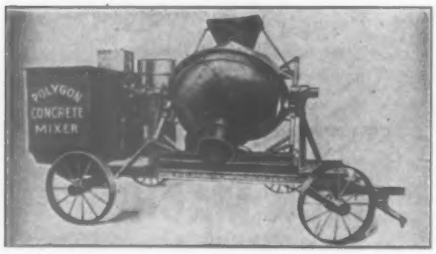

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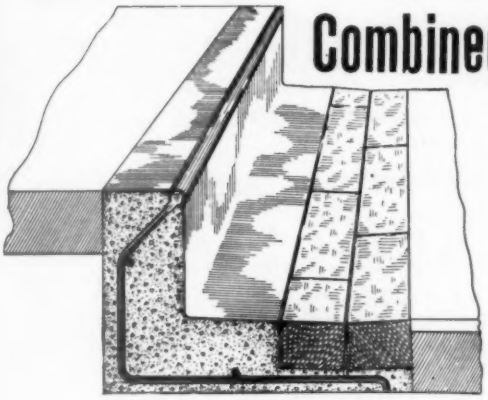

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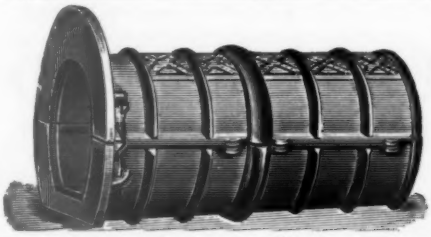

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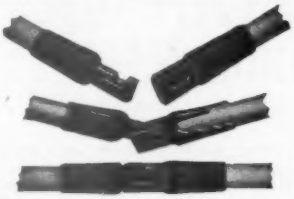

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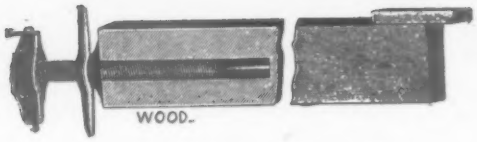

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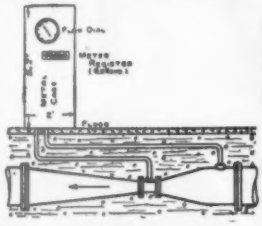

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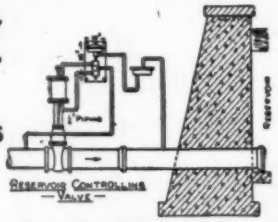

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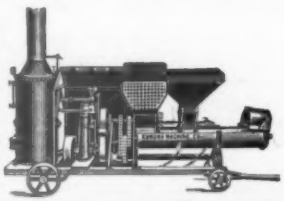

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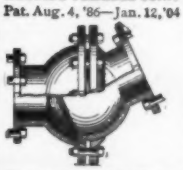

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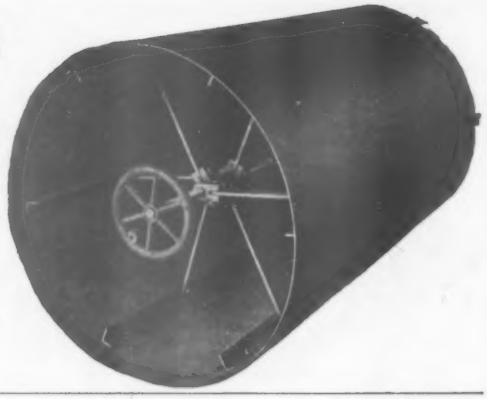

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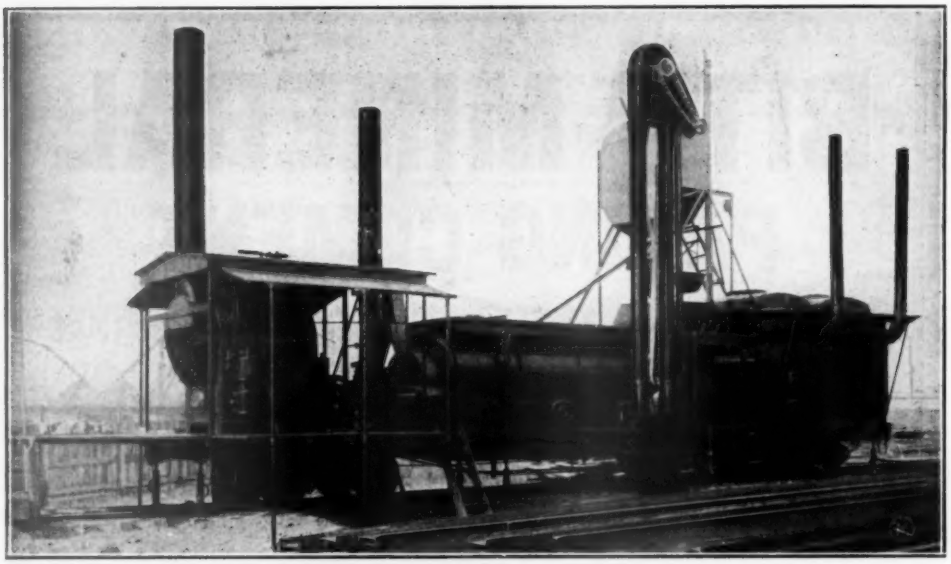

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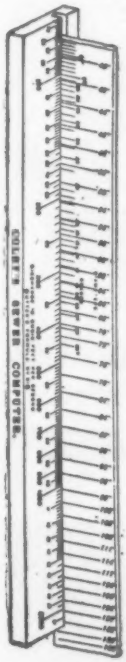

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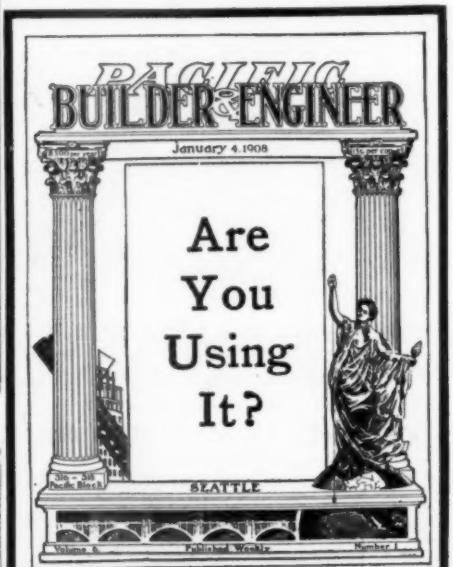

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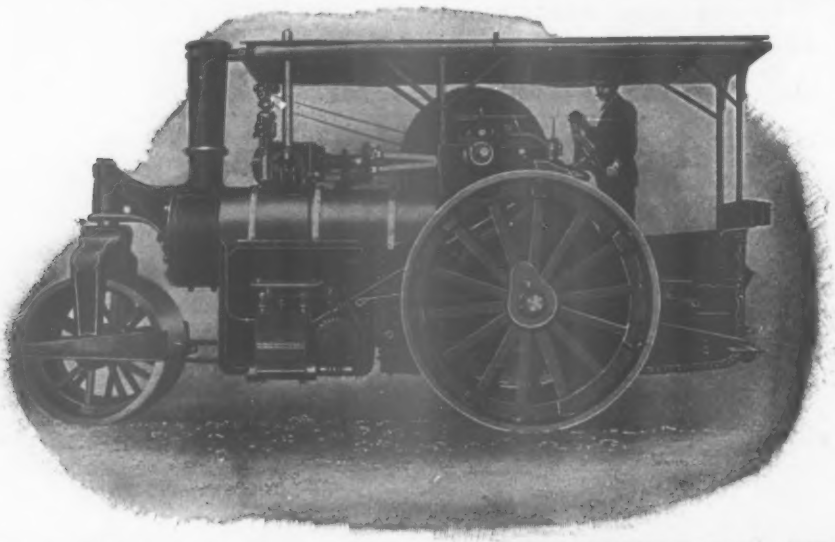

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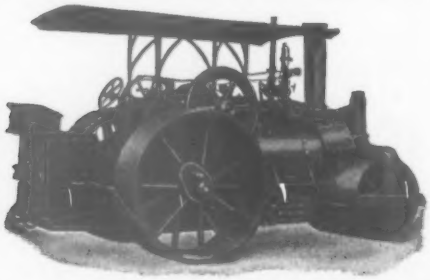

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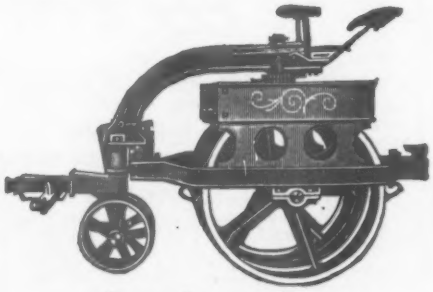

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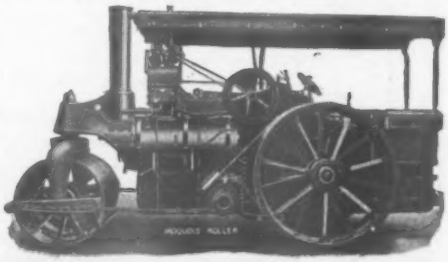

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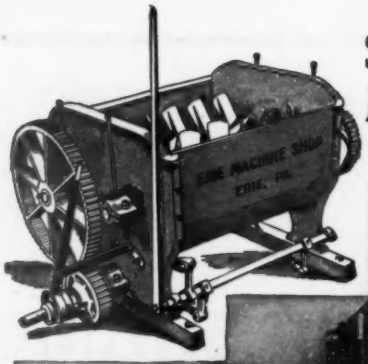

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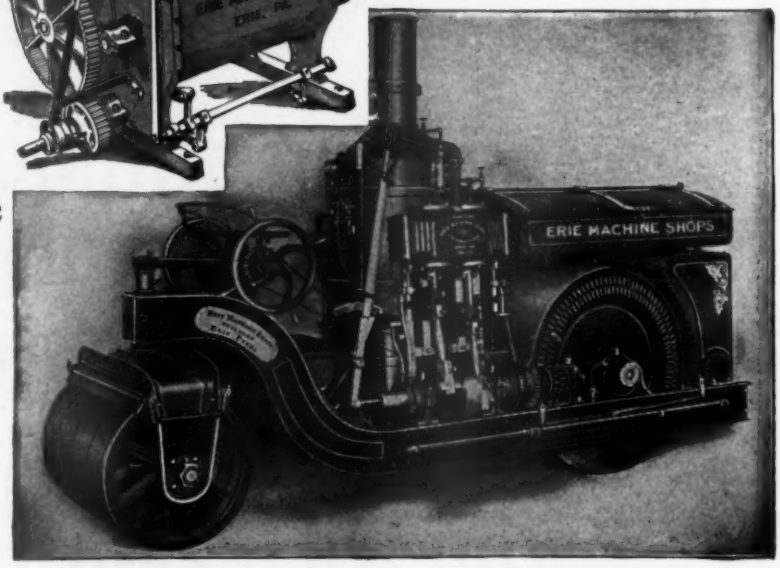

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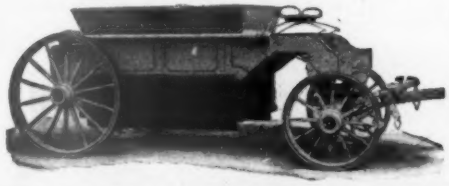

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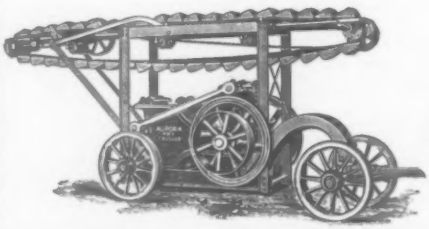

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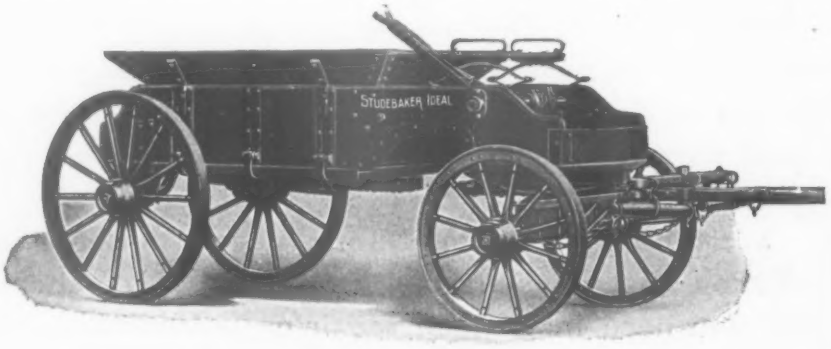

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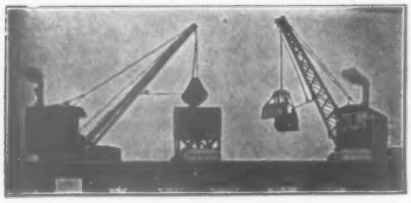

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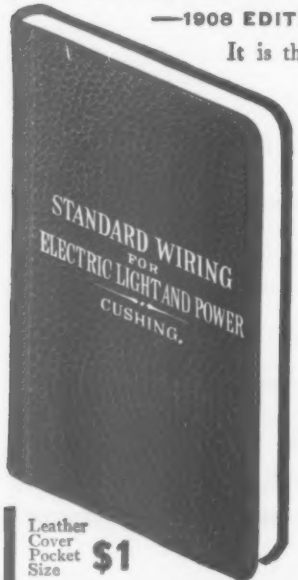

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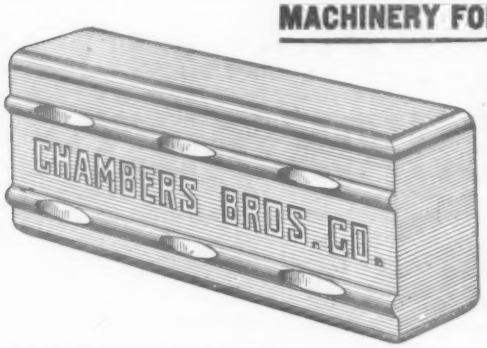

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EQUAL TO STONE AT THE COST OF STEEL
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Concrete and Stone Bridges a Specialty

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If you want the Best System of.....Book-Keeping for Water Companies, write to Municipal Engineering Company. To use it Saves and Pays....

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Alsen's has positively the best and most uniform color from an artistic viewpoint. Alsen's stands more abuse than other brands, and increases steadily in practical work year after year. This has been proven under the *varying conditions sure* to be met in *large contracts*—very different from laboratory results. Alsen's combines advantages found in no other brand—that is why it is shipped all over the world. We can make attractive quotations on either American or German, by water or rail, to anywhere, in any package.

Fifty Years Experience Better Than Assertions

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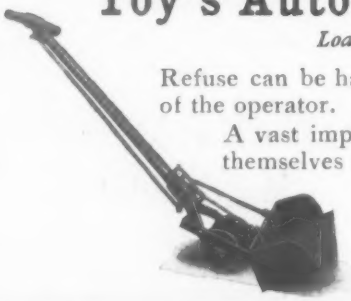
Loads and Dumps Automatically



Refuse can be hauled any distance and dumped at the will of the operator. Strong, well made and reasonable in price. A vast improvement over old method and will pay for themselves in a short time.

Sent on 30 days' trial.

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Brick Dies, Moulds and Piano Wire Screens are positively

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LET US FIGURE WITH YOU PORTSMOUTH, OHIO

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WANTED—Superintendent of experience on municipal work, especially asphalt. The Parker-Washington Company, St. Louis, Mo.

NOTICE.

Notice of Letting Construction of Free Gravel Road in Ross Township, Lake County, Indiana.

Notice is hereby given that on Monday, July 6, 1908, at 12 o'clock, noon, at the auditor's office, in Crownpoint, Ind., the Board of Commissioners of said county will let to the lowest responsible bidder the construction of a certain gravel road in Ross township, in said county, as petitioned for by Fred Krieter et al., according to the viewers' report now on file in the auditor's office.

Sealed bids may be left with the undersigned auditor up to 12 o'clock m. of the day of letting the work.

Bond for double the amount of the bid must accompany all bids, one of the sureties must be a resident of Lake county, Indiana, or a surety company authorized to do business in Lake County, Indiana, the same to be returned to unsuccessful bidders. The right to reject any and all bids is reserved.

SAMUEL A. LOVE,
MATHEW J. BROWN,
OSCAR A. KRINBILL,
Board of Commissioners,
Lake County, Indiana.

Attest:
CHARLES A. JOHNSON,
Auditor Lake County, Indiana.

NOTICE FOR BIDS.

Notice is hereby given that sealed bids will be received by the Board of Commissioners of Monroe county, Indiana, at the Auditor's office, in Bloomington, Ind., at the hour of 2 o'clock p. m., on Wednesday, July 8, 1908, for the construction of a road on the line between Richland and Van Buren townships, as petitioned for by W. D. Ward and others.

Each bid must be accompanied by a bond payable to the State of Indiana in the penal sum of double the amount of the bid.

The board reserves the right to reject any and all bids.

SAMUEL M. KERR,
Auditor Monroe County, Indiana.

CONSTRUCTION OF PIKE ROADS.

Sealed bids will be received at the court house in Clinton, Tenn., up to 1 o'clock p. m., July 3, 1908, for the construction of about 38 miles of road and five thousand dollars worth of work in the town of Clinton, grade and macadam. The pike road work is in sections, ranging from one-half to about 1½ miles. Profiles and specifications on file after June 15, at office of trustee in courthouse. Certified check amounting to 5 per cent. Certified check amounting to 5 per cent. of bid will be required. The commission reserves the right to reject any or all bids.

J. W. P. WALLACE, Chairman.

NOTICE TO CONTRACTORS.

Batavia, Ill., June 4, 1908.

Sealed proposals will be received by the Water Committee of the City of Batavia, at the office of the City Clerk, until five o'clock p. m. on the 6th day of July, A. D, 1908, for furnishing all materials and construction approximately:

17,019 feet of 4-inch cast iron water main.
860 feet of 6-inch cast iron water main.
18 Hydrants.
4 6-inch Valves and valve boxes.
32 4-inch Valves and valve boxes.
3 ⅝-inch corporation cocks and boxes.
1 ¾-inch service cock and box.
150 feet of 3-inch sewer tile, laid to average depth of 6 feet.

Plans and specifications can be seen at the office of the City Clerk, at Batavia, Illinois.

All bids must be submitted upon blank forms furnished by the Committee, and to be accompanied with a certified check for an amount not less than 10 per cent. (ten per cent.) of the total amount of the bid.

Payments for the work shall be made from the Water Fund, as provided for by law.

The Water Committee of said City of Batavia reserves the right to reject any and all bids or to waive any informality which may be to the interest of the said City.

WATER COMMITTEE,
Batavia, Ill., 1908.

POSITION WANTED—As superintendent. Have had twelve years experience in building construction, concrete work, etc., drawing plans for dwellings, etc. Will gladly furnish reference. F. L. B., Rio, N. Y.

EVERY CAPABLE MAN who wants to better his position may receive free list of openings by stating age, experience and salary desired. HAPGOODS, 516 Traction Terminal Building, Indianapolis, Ind.

Waterproofing Cement Work

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Capacity, 1 to 5 Yards

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You can use it on old gears and can couple up to 65 inches. The box is absolutely tight and dumps clean. It is easy to operate and has no delicate mechanism to get out of order. The material is the best that money can buy and the prices are so low that you can save 75 per cent on the cost of your equipment. **Write for Catalogue No. 12**

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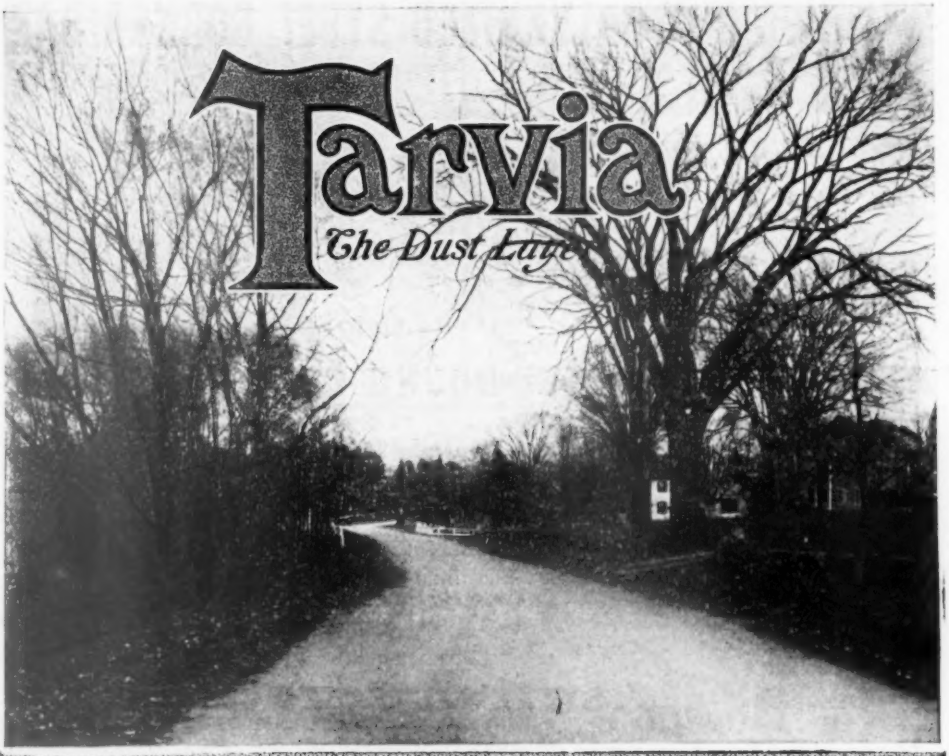

State Highway, Wayland, Mass., made dustless with Tarvia "A"

DO AWAY WITH THE DUST NUISANCE

The way to suppress dust is to have no dust to suppress—to prevent its creation by making the macadam capable of resisting traffic without pulverizing. Macadam was invented before automobiles and was fairly durable and dustless under ordinary traffic. Today the traffic conditions are so much harder that the macadam rapidly disintegrates into dust. Its crying need is an additional binder—something to prevent dust and add to its life. Tarvia does both because it is poured over the macadam and allowed to solidify there, forming an elastic, durable, water-proof matrix. The fine particles of stone are so imbedded in this cement-like binder that even automobile tires fail to tear them loose. In appearance a road so treated resembles asphalt, but as the surface is slightly absorbent it is more dustless. One treatment, applied like oil, lasts an entire season and costs (for the cold application) about $300 a mile. The top dressing of fine stone can be omitted altogether, as Tarvia performs its functions of shedding water and cushioning the number two stone well enough. It is cheaper, therefore, to maintain a macadam road with dust-preventing Tarvia than with dust-producing stone screenings.

For parks and boulevards, where the very finest roads are demanded, and for newly constructed streets, we recommend the older style of Tarvia which requires heating before application. It makes an ideal, smooth, well-bonded road, but of course its cost is a little more. For ordinary macadam roads and village streets the cold application will be found perfectly adequate.

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WAINWRIGHT GALVANIZED STEEL CORNER BAR

For Protecting Edges of Concrete Curbs, Steps, Columns, Etc.

The only effective **CONCRETE EDGE PROTECTOR** offered to the contracting public

WAINWRIGHT PATENTS—March 9, 1897. November 22, 1898. May 5, 1903. March 26, 1907. August 29, 1907.

This bar is well galvanized so it will not rust. Has a **solid head,** guaranteeing resistance from the heaviest possible impact of wheels or other heavy bodies, and is held in place by a **dove-tailed web** forming an anchorage extending its full length, not only anchoring but supporting the **solid head** every inch of its length.

This bar has been in public use for more than ten years as the main feature of the

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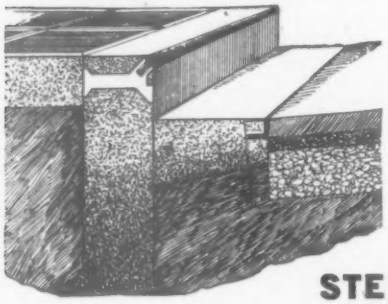

THE BEST IN THE WORLD

OVER ONE MILLION FEET

In use in more than one hundred and fifty cities in the United States.

The **dove-tailed web** anchors the bar at all points, resulting in great superiority over a corner protector anchored by bolts, wires or rods at intervals, allowing buckling or expansion, causing ultimate loosening of the metal from the concrete.

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Correspondence invited.

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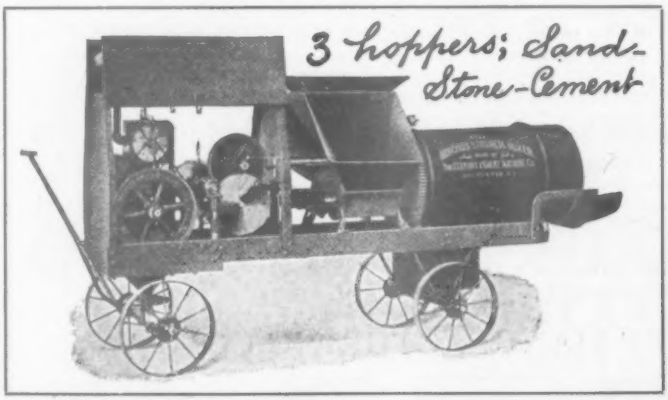
Do You Make and Lay Sidewalks?

Then You Need a HERCULES Concrete Mixer

It will save you *money*, *time* and *labor*, besides giving you *better concrete*. It's just what you've been looking for—a first-class machine that can *really* be depended on for properly *proportioning* and *mixing* concrete—all that is necessary is to keep the hoppers filled.



The Hercules Mixer proportions the materials *accurately*, then mixes them thoroughly. Proportions can be changed instantly without the use of *sprockets*, *chains* or *belts*. The proportioning feed once set for a given proportion cannot possibly get out of adjustment. Proportions cannot vary because it's a *forced* feed and *not a worm feed*—that's what makes it reliable.

You can regulate the capacity to meet the requirements of the number of men employed. The hoppers are low, allowing you to shovel direct from the ground without the aid of a platform. Either hopper can be used for coarse or fine material as desired.

There are no movable paddles to wear and break and partially mix, because it's a continuous drum mixer, and while continuous can be used as a *proportioning batch mixer* by merely shutting off the feed and allowing the drum to run. The entire machine is always in perfect control of the operator and can be started and stopped instantly. This machine is a long step in advance of anything that has hitherto been made in the mixer line. Send for catalogue and full information to-day.

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Not A Brick Displaced!—Not A Mark Of Erosion!

This was the finding upon recent examination of the big tube of the Niagara Falls Power Company, when the great torrent was unharnessed after nearly twenty years of unceasing flow through its mile and a half of winding tunnel.

These bricks were laid in

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Burned in Rotary Kilns.
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OMEGA PORTLAND CEMENT CO.
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ITS PRODUCT IS SEASONED

Before shipping and guaranteed to withstand satisfactory neat and sand tensile strains—cold and hot water tests; chemical and sieve tests. We grind 98 per cent. fine on sieve of 20,000 meshes.

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Every barrel and bag guaranteed both as to quality and weight

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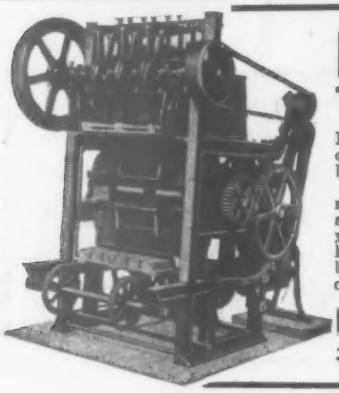

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The Hohn Power Tamp BRICK MACHINE

Is not an experiment. It is in successful operation and turns out concrete brick *tamped*, at the rate of **Twenty Thousand** perfect brick per day of ten hours.

The only hand work required is in putting the material in the mixer and removing the finished brick. This machine is strong and well made and will do what we claim for it or we don't want your money. Any man who understands concrete and can lay his hands on some good sand, can build up a large and profitable business with this machine. We furnish the machine alone or complete plant with all equipment. *Write today for our circular.*

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A Standard Portland for Universal Use.

Daily Output 17000 Barrels. Plants at Chicago & Pittsburg.

MUNICIPAL OFFICIALS can do no better than to require the use of Universal Portland Cement in the concrete work with which they are concerned.

The leaders in the building profession insure themselves against weak concrete due to poor cement and against the costly delays resulting from inadequate shipping facilities, by using Universal Portland Cement. Insist on Universal.

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Always a favorite with the trade. Never a barrel rejected.
Capacity 8,500 barrels per day.

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It is worth several times the price even to an old experienced concrete man, and such the reviewer considers himself.—*Journal of the Western Society of Engineers.*

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METHODS and COST

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Managing Editor, *Engineering-Contracting*,

and

Charles S. Hill, C. E.
Associate Editor, *Engineering-Contracting*

THIS book handles the subject of concrete construction entirely from the view-point of the **builder** of concrete structures. The testing of cement, the physical properties of cements and concrete, and the design of concrete structures are not considered. The aim of the authors has been to eliminate all matter not germane to the constructing end of their subject. By doing this it has been possible to crowd a vast amount of detailed information on methods and cost of concrete construction into a volume of moderate size. The book is a treatise on the **methods and cost** of building in concrete.

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a book containing besides several general chapters on concrete, concrete aggregates, methods and materials for reinforcing—*ten chapters giving detailed descriptions of ten Concrete Factories and Warehouses* erected in various parts of the country by different systems. The photographs, sectional drawings and specifications for this book were furnished by the engineers in charge of the work.

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It is especially indicated for the highest class of concrete construction.
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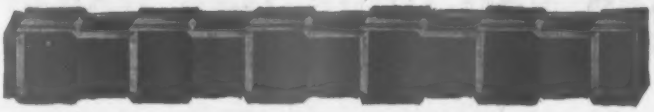

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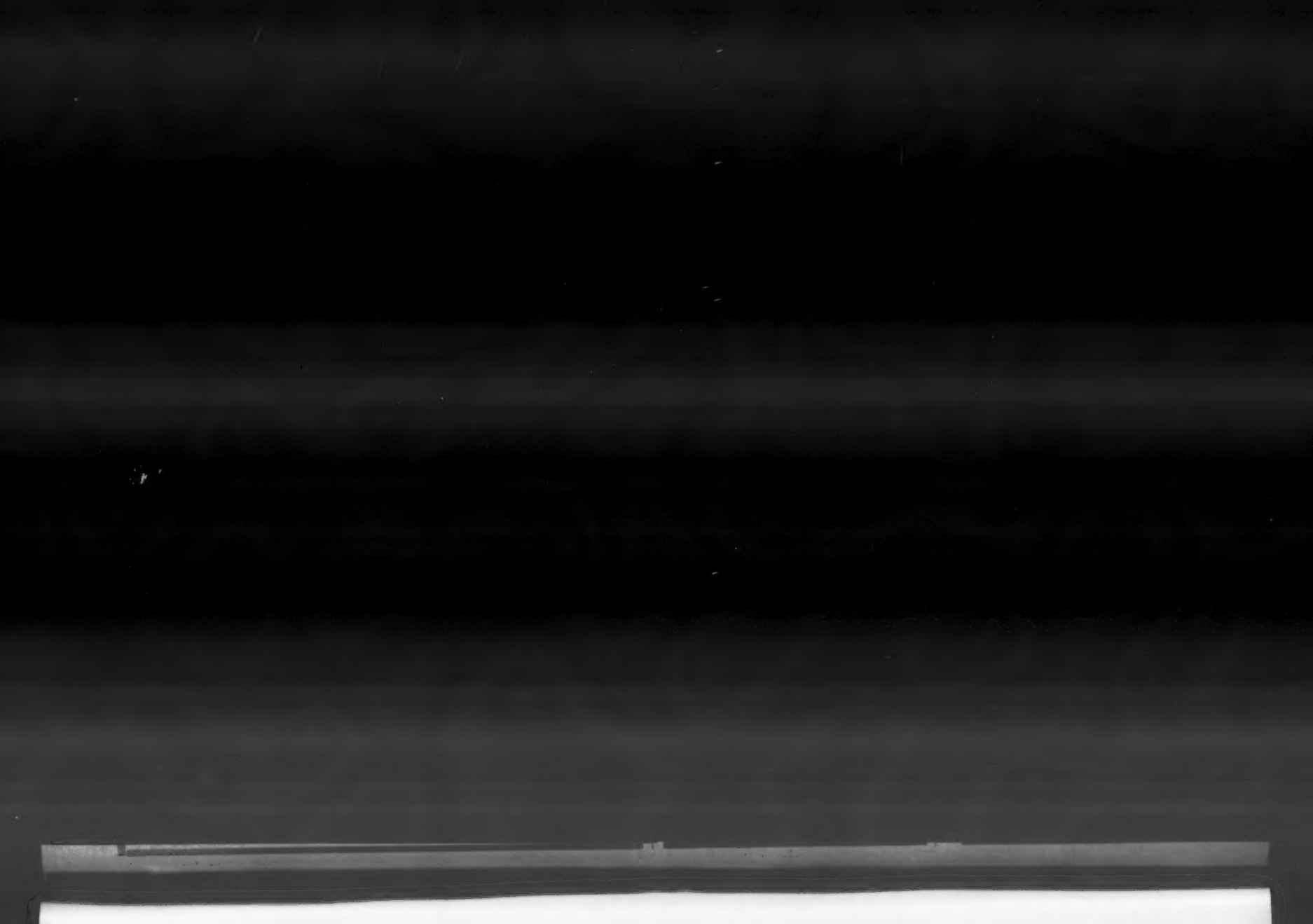

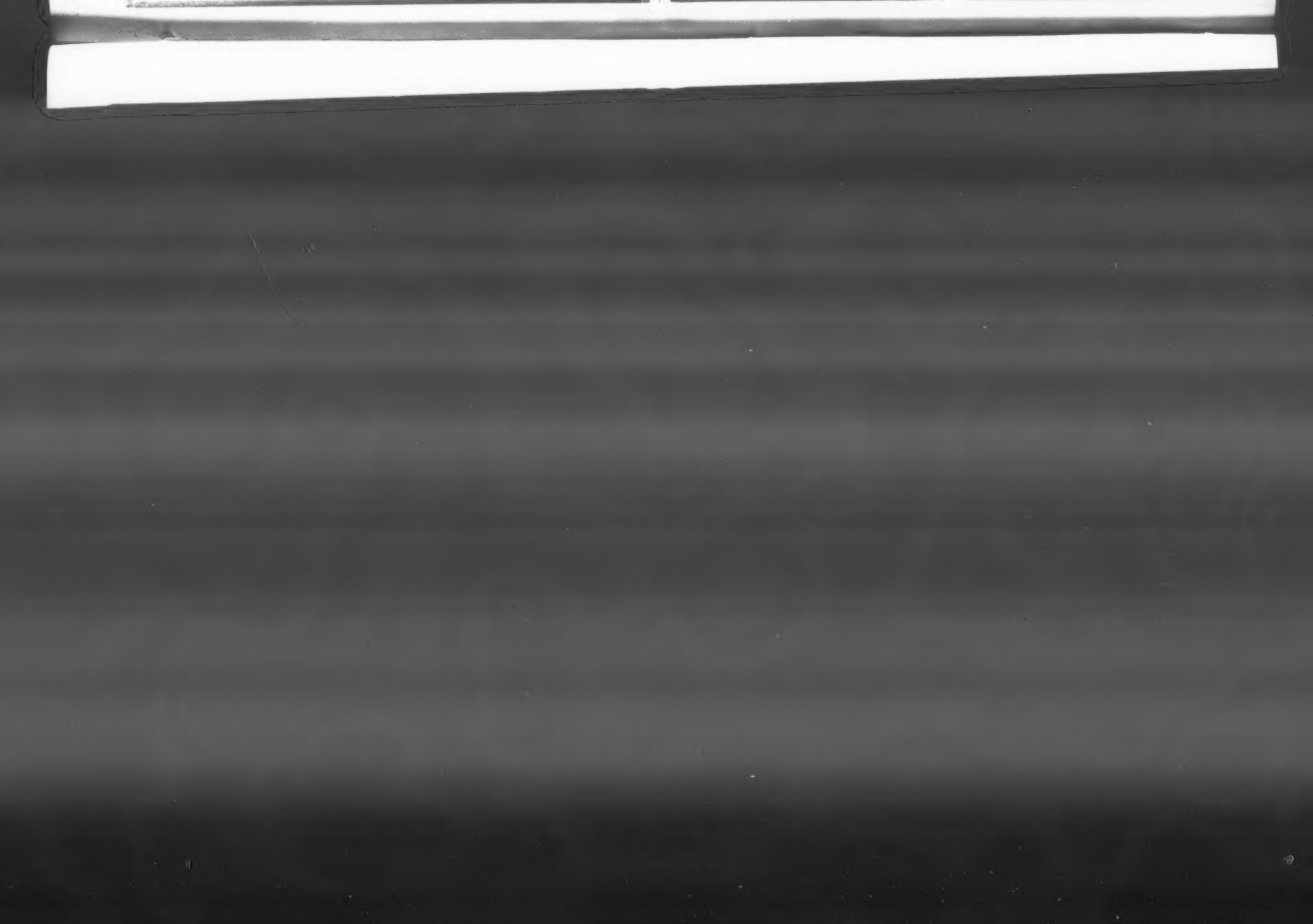

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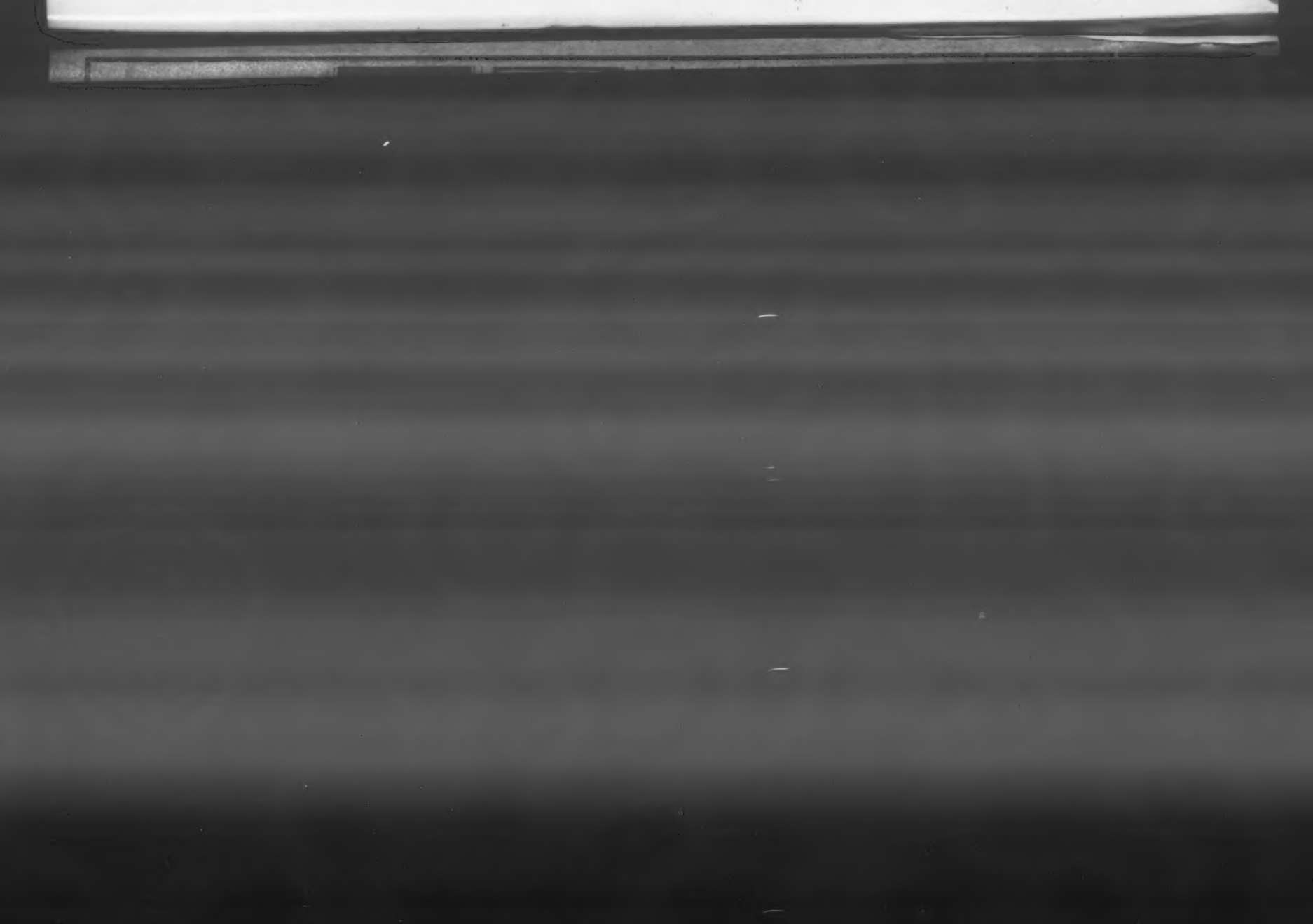

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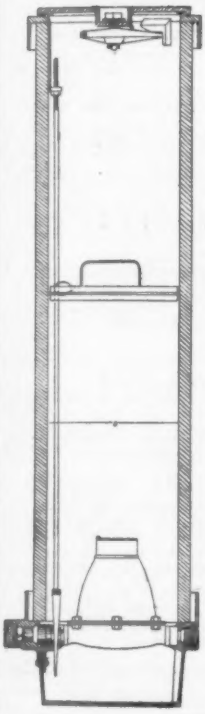

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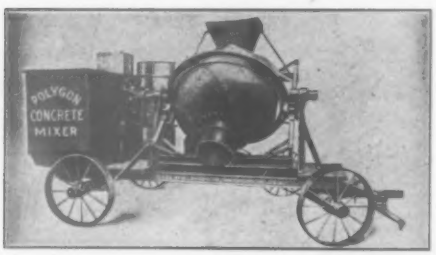

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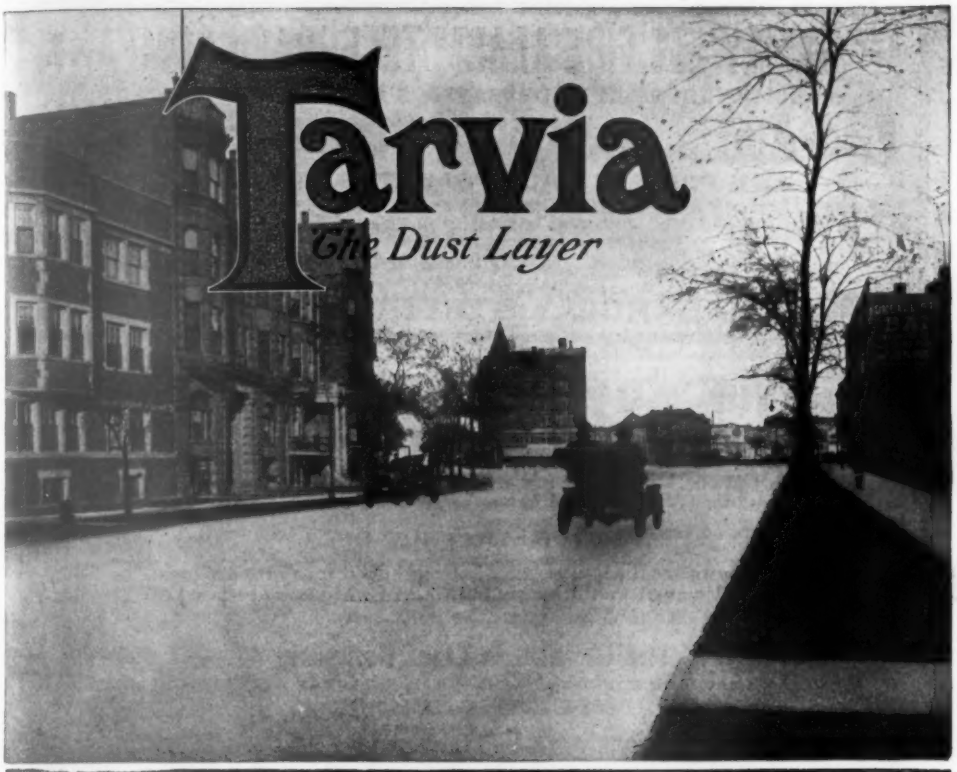

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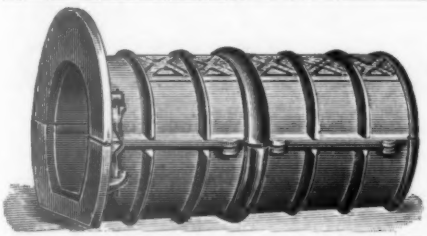

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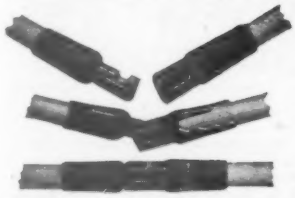

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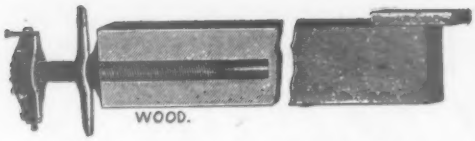

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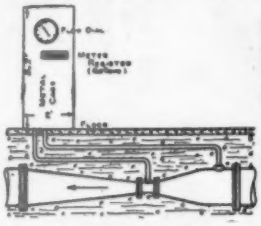

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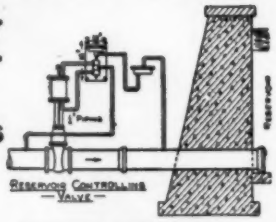

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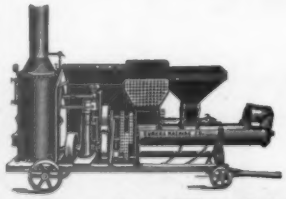

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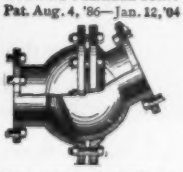

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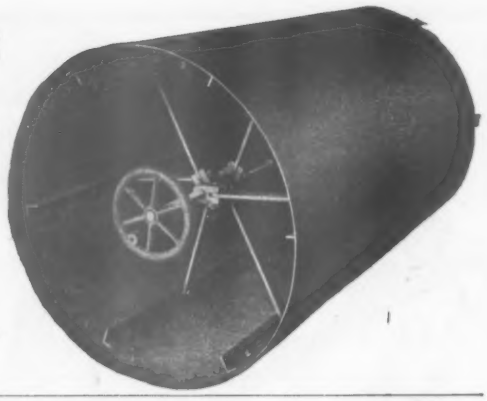

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Municipal Engineering Magazine continues to occupy the first place in the estimation of its readers. The reason is because it gives them good, practical, helpful information. We go to endless trouble to furnish our readers the information they want, and their appreciation is shown by their continued subscription and countless letters of praise and good will.

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"I am glad you are putting out such an interesting and valuable publication." GEORGE PRENTISS ROBINSON,
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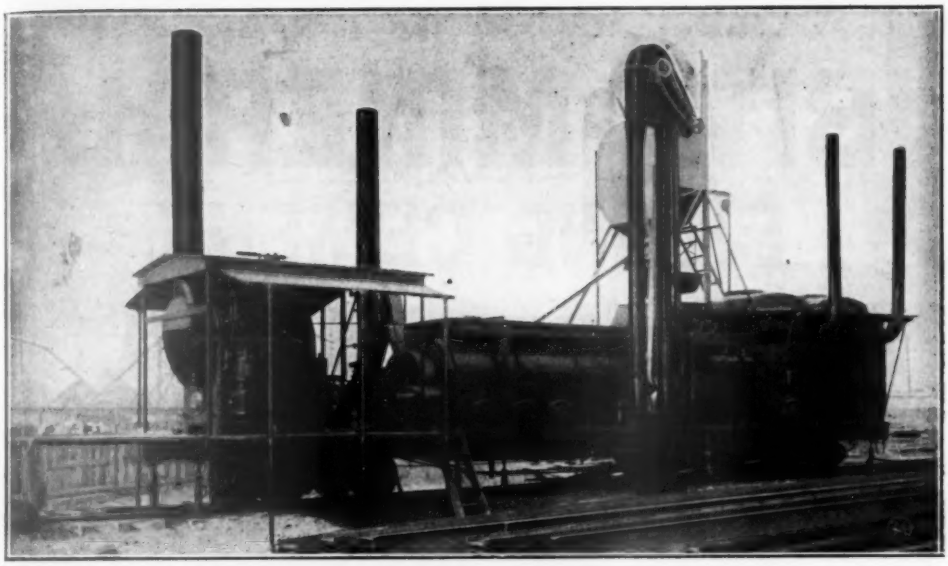
You can't think of anything good that has not been said of Municipal Engineering by its readers



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Selling fast as we can turn them out. No failures.
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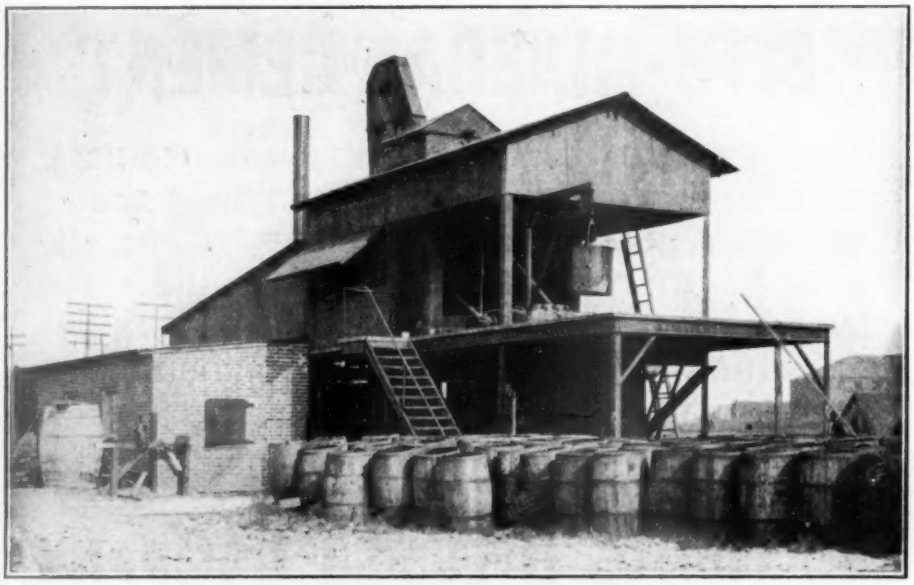

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An American roller, made in an American factory, by American workingmen.

Made in Four Sizes:

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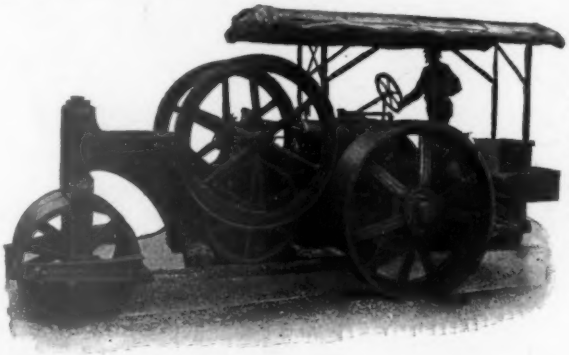
It can do anything and everything which the very best type of Steam Roller can do. It can do it more easily, more efficiently, more economically and less objectionably



Operated by gasoline or denaturized alcohol.

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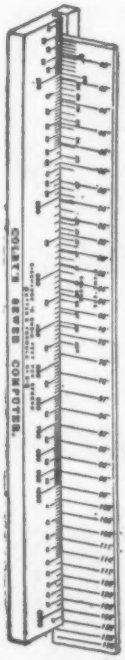

WHAT IT IS

This instrument is Kutter's formula in the form of a slide rule. The values obtained are the same as given by Kutter's formula; the value of the coefficient "N" being taken at .013. The cut shows only a portion of the entire computer. The divisions on the limb represent discharge in cubic feet per second. On the slide are two scales, the divisions of one indicate different diameters of sewers in inches; the divisions of the other represent the per cent. of grade. The computer can be used by any one after one minute's explanation.

Colby's Sewer Computer gives correct results according to Kutter's formula. It is accurate and perfect in every respect. It is 21 inches long and weighs a few ounces. Full directions with each computer.

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RETURN IT IF NOT SATISFACTORY

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This is an Indispensable Article In the Equipment of Every City Engineer's Office

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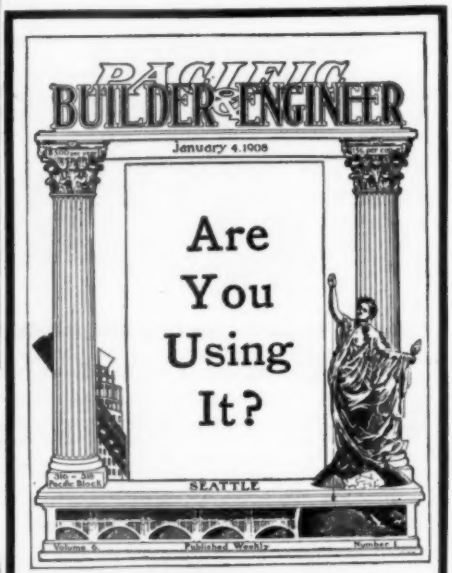

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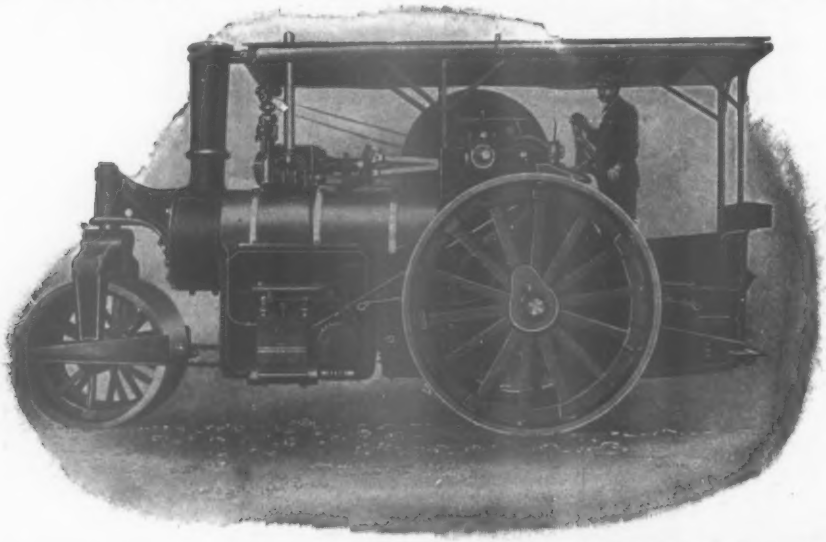

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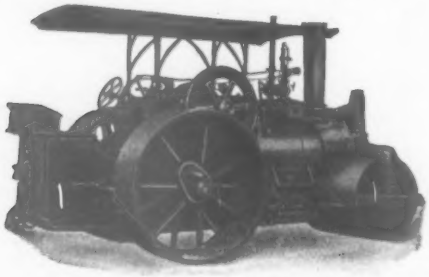

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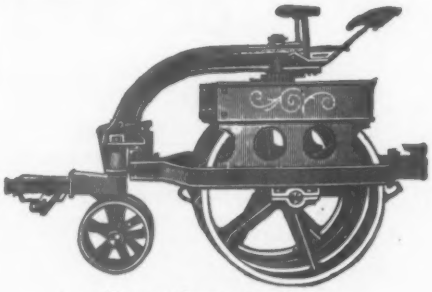

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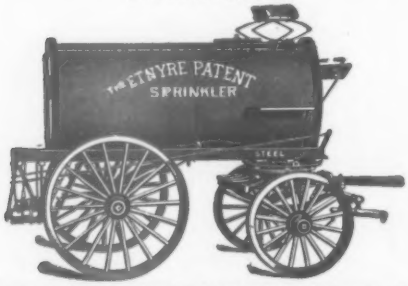

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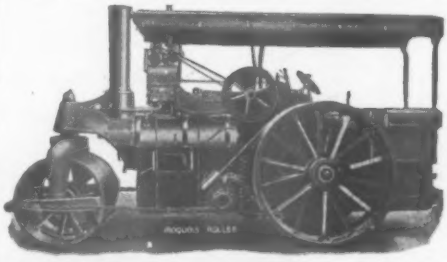

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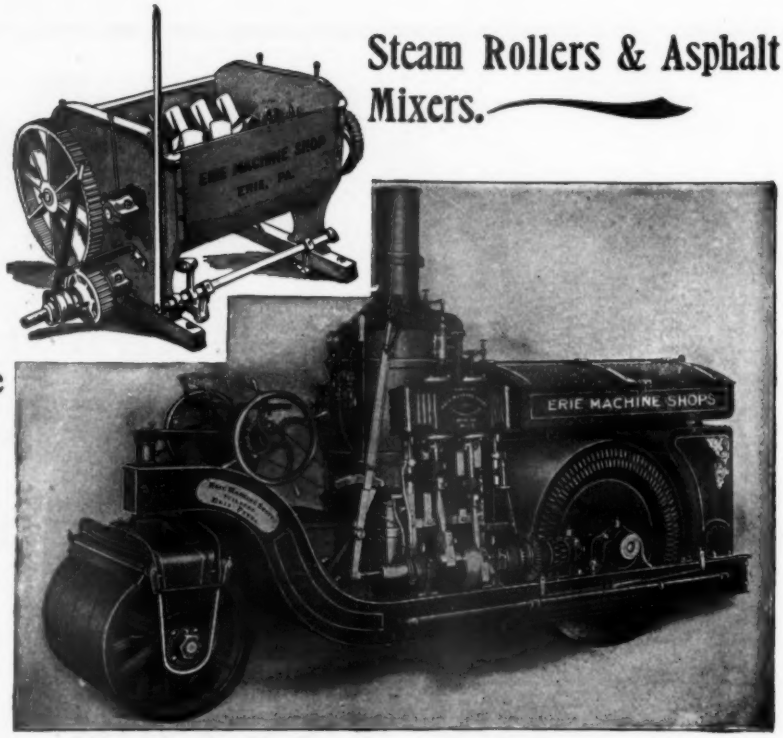
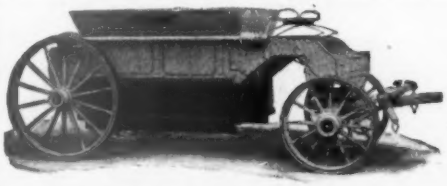


Erie Machine Shops { P. W. DIETLY, Proprietor. Cor. 13th and Peach Sts., ERIE, PA.

TO the casual observer all dump wagons look alike. The fact is, however, that there are many very important differences underneath any seeming similarity. The next time you see a dump wagon note, for example, the mechanism used to raise the bottom doors. If it is not a Troy, you will see sprocket chains, rods, numberless link chains of the ordinary kind, and any number of contraptions



If it is a Troy you will see just one long tubular shaft, around the ends of which wind two chains in spirally grooved drums. That's all—that's a Troy. Then take a look underneath the wagon and note how the Troy steel doors overlap, sealing the wagon perfectly against leakage. Then write for our CATALOG No. 2F, and learn more about the simplest, strongest, tightest dump wagon made.

The Troy Wagon Works Co. Crawford St. **Troy, O.**

U.S. OR CANADA **PATENTS** $25.00

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merit the widespread approval given them:
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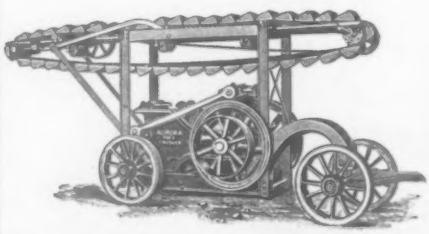
THE **AURORA** JAW CRUSHER HAS FEWER PARTS
than any other crusher of similar capacity, consequently
THE AURORA NEEDS FEWER REPAIRS

STRENGTH + LIGHTNESS + SIMPLE DUMPING DEVICE =
AUSTIN DUMP WAGON



A WORD OR TWO ABOUT STRENGTH
A BRIEF THOUGHT ABOUT REPAIRS
A SUGGESTION REGARDING EASY DRAFT

Thoughts for the Man Buying Dump Wagons

If you doubt that Adirondack Birch makes the strongest body for dumping wagons, if you think that other spokes are as good as the second growth, 'A' grade, White Oak spokes we use—just ask men who have used different makes of dump wagons alongside of WATSON'S.

Accidents put Watson Dump Wagons out of commission sometimes—heavy work rarely affects them. All you need in Watson repairing is two hands, a monkey wrench and duplicate part—no long wait at a blacksmith shop.

On the XL Watson Wagon shown here, the design of the front circle will commend itself to you. Easiest draft of any dump wagon in the world.

Get a Catalog

WATSON WAGON COMPANY
CANASTOTA, N. Y.

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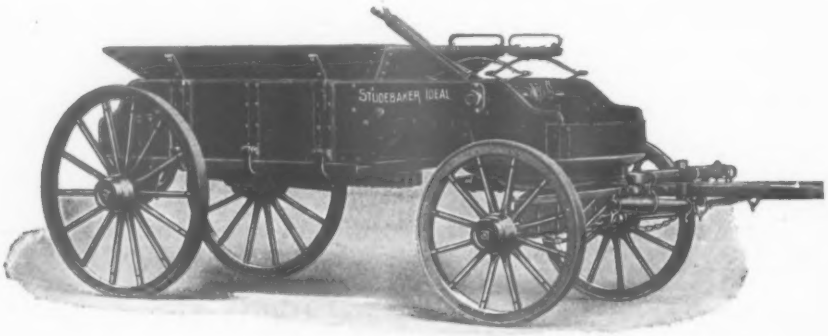
A Big Contractor Backs His Opinion *of the* Studebaker DUMP WAGON

The Pollock Drayage & Storage Company, Inc., Washington, D. C., who use Studebaker Ideal Dump Wagons on their big Washington City contract, write as follows: "We have used this wagon in connection with the contract we have with the District of Columbia for the removal of ashes ever since we



commenced, and find it to be the best wagon for this work. We have had in use several different kinds of wagons, but have reached the conclusion that the "STUDEBAKER" is the strongest and the best wagon in the market today, and have just placed our order for ten additional wagons."

The Strongest Evidence

We might tell you why the "STUDEBAKER" is the best all-around dump wagon made. But more convincing than anything we could say is the voluntary testimony of prominent contractors who have actually tested others, and back up their opinions by ordering additional "STUDEBAKERS." Let's hear from YOU.

Send for Detailed Description

Studebaker Brothers Mfg. Co.

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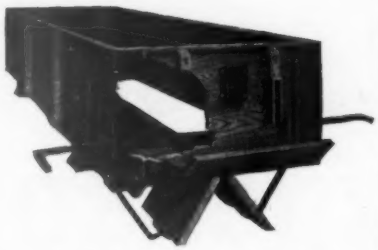

THE CHICAGO QUICK DUMPER (OPEN)

Use Your Own Wheels

and let us furnish the Box that will make you a complete dump wagon. A convertible wagon is a big advantage and a big saving to a contractor.

The **Chicago Quick Dumper** enables you to have a wagon without a box or with a box at your will. It is a high class, bottom door, sand tight dumping wagon box which can be put on and taken off any running gear which has a reach. In addition it is a box so designed that it distributes the load equally over the front and rear wheels and allows the gear to be coupled up as close as 65 inches.

WRITE FOR CATALOGUE NO. 12

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126 East Ohio St., CHICAGO, ILL.

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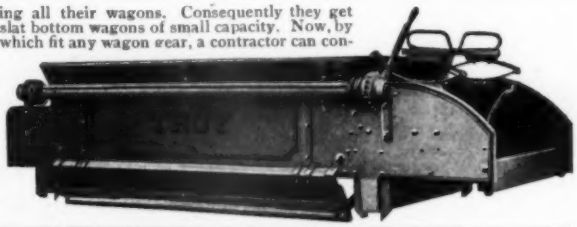

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For Sand, Clay, Rock, Marl, All Materials

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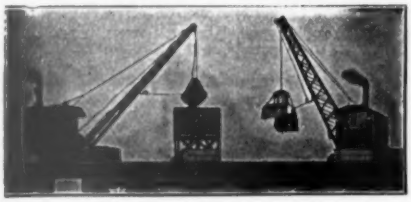

BROWNING LOCOMOTIVE CRANES

handle coal in large quantities, rapidly. This picture shows the cranes transferring coal from river barge at the rate of 300 tons per hour.

DESCRIPTIVE BULLETINS SENT ON REQUEST

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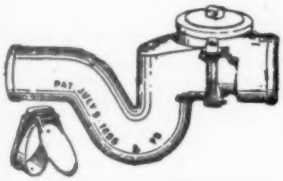

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Saves Labor Saves Expense

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If you want to start right send your order for the books now.

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It is a comprehensive system of bookkeeping, founded upon the latest and best accountant methods as applied to the needs of Water Companies.

WHAT IT DOES

It saves time and labor, eliminates unnecessary entries, reduces liability to mistakes, and simplifies the whole method of the keeping of records. ALL THIS SAVES MANY TIMES THE COST OF THE BOOKS.

HOW IT WAS DEVELOPED

The American Water-Works Standard Bookkeeping System is based upon a careful study of methods in use by Water-Works Companies throughout the country, and embraces the good features of them all. It is the outgrowth of a competition instituted by MUNICIPAL ENGINEERING MAGAZINE, in which prizes were offered for the best set of forms. In response to this call many blanks were received from points throughout the United States and Canada, and after a careful examination of them by a committee, the prizes were awarded.

NO ONE SET, however, was found to embrace all the good points of others and many of the better ones were cumbersome in the extreme. These forms were afterwards taken in hand by competent accountants and carefully studied, and, after a thorough sifting and pruning, the best features of them all were embodied in The American Water-Works Standard Bookkeeping System.

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It is the best Bookkeeping System for Water Companies ever devised and the books are the cheapest.

A large number of Water Companies under both public and private ownership in every state in the Union are now using this system.

It has so many real advantages that it is worth your while to investigate.

Write for booklet giving full description.

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Upon application, we mail, free of charge, to any address in the United States or Canada, full specifications which, carefully followed, will result in a street that will convince any fair observer that a brick street has the advantage, considered from every point of view, over any other form of improved pavement. Address

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Two Plants. Daily Capacity, 100,000. **PORTSMOUTH, OHIO**

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HIGH-GRADE PAVING BRICK MADE FROM THE FAMOUS SCIOTO SHALES

33% Saved by Using Our Brick Clamp

Write DUPLEX MANUFACTURING & FDRY. CO.
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MANHOLES, CATCH BASIN COVERS, MONUMENT COVERS—A FULL LINE

THE BEST PAVING BLOCK MADE

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We own and operate the finest and one of the largest SANDSTONE plants in Ohio, and make a specialty of machine dressed (something new) and split curbing and sawed flagging. We also furnish BUILDING STONE and GRINDSTONES in any quantity.

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For 15 years, leaders, in the Middle West, in the manufacture of high-grade paving material; in use in 70 cities and towns within a radius of 200 miles of

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OF GALESBURG, ILL.

Manufacturers of

REPRESSED PAVING BRICK AND BLOCKS

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ALSO SIDEWALK BRICK

The towns using our material are too numerous to mention here, but we will gladly send a list of them for the asking

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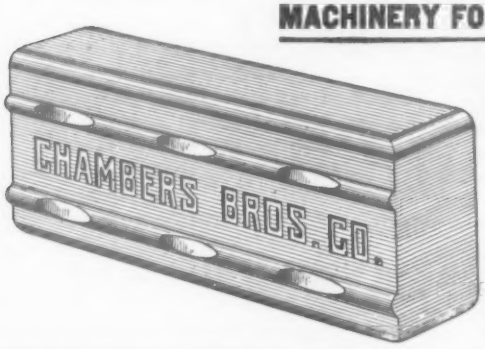

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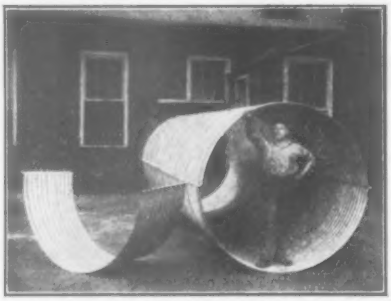

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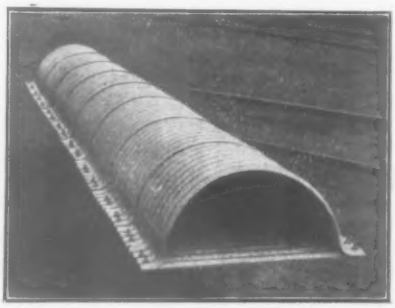

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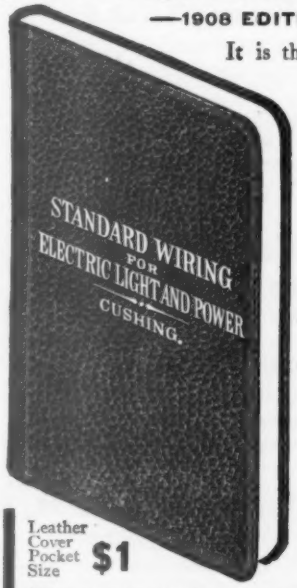

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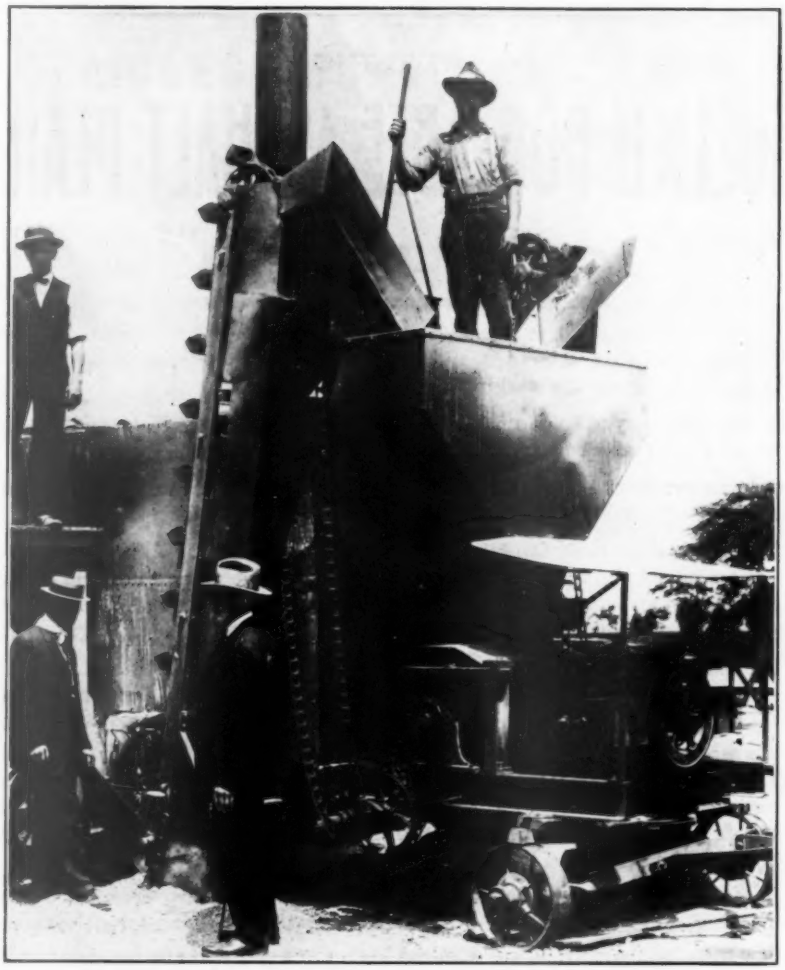

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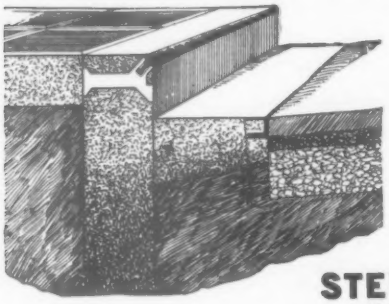

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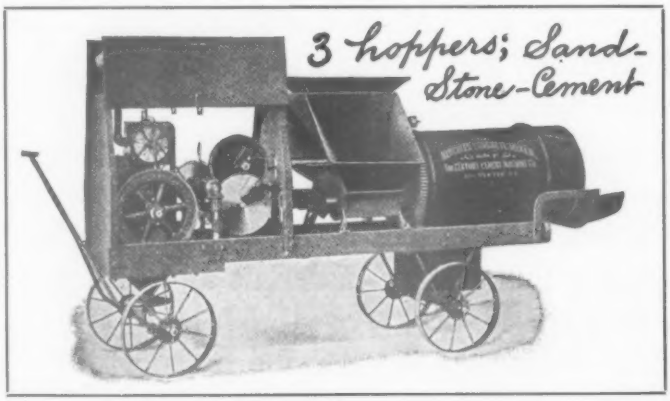

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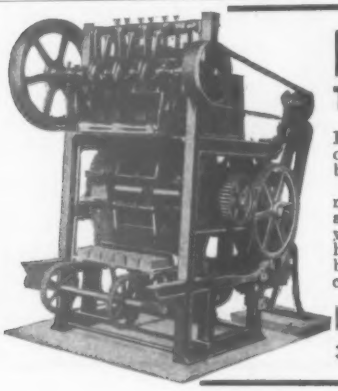

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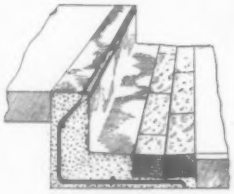

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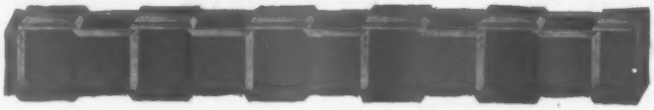

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Miracle Pressed Stone Co., Minneapolis, Minn.

Combined Curb and Gutter.
Rudolph S. Blome Co., Chicago, Ill
Concrete Edge Protector Co., Detroit, Mich.
Steel Protected Concrete Co., Philadelphia Pa.
Warren Bros. Co., Boston, Mass.

Concrete Blocks.
Century Cement Machine Co., Rochester, N. Y.

Concrete Construction Machinery.
Century Cement Machine Co., Rochester, N. Y.
Eureka Machine Co., Jackson, Mich.
Koehring Machine Co., Milwaukee, Wis.
L. T. McFarland, Van Wert, O.
Miracle Pressed Stone Co., Minneapolis, Minn.
Waterloo Cement Machinery Co., Waterloo Iowa

Concrete Edge Protector.
Concrete Edge Protector Co., Detroit, Mich.

Concrete Mixers.
Chambers Bros Co., Philadelphia, Pa.
Eureka Machine Co., Jackson, Mich.
Jeffrey Mfg. Co., Columbus, O.
Koehring Machine Co., Milwaukee, Wis.
Miracle Pressed Stone Co., Minneapolis, Minn.
Waterloo Cement Machinery Co., Waterloo Iowa.

Concrete Steel Arch Bridges.
Concrete Steel Engineering Co., New York City.
Osborn Engineering Co., Cleveland, O.

Concrete Work.
T. J. Backus Construction Co., Dayton, O.
Rudolph S. Blome Co., Chicago, Ill.
Central Paving Co., Chicago, Ill.
Geo. W. Clark, Wausau, Wis.
Concrete Edge Protector Co., Detroit, Mich.
Geo. W. Fife, Indianapolis, Ind.
L. T. McFarland, Van Wert, O.
J. E. Salfisberg & Co., Aurora, Ill
Sanitary Sewer Construction Co., Jackson, Mich.
John A. Spencer, Grinnell, Ia.
Clifford A. Tinker, Westfield, Mass.
Warren Bros. Co., Boston, Mass.

Consulting Engineers.
J. Walter Ackerman, Auburn, N. Y.
C. R. Allen & Son, Ottumwa, Ia.
Dow & Smith, New York City.
H. Whitford Jones, Cleveland, O.
E. B. Lynn Engineering Co., Cincinnati, O.
Harry J. MacDargh, Dayton, O
J. J. McVean, Grand Rapids, Mich.
F. R. Meier, New York City.
New York Sewage Disposal Co., New York City.
Osborn Engineering Co., Cleveland, O.
F. A. Pease Engineering Co., Cleveland, O.
Alexander Potter, New York City
Power Specialty Co., New York City.
John C. Sparks, New York City.
A. D. Thompson, Peoria, Ill.
M. Tschirgi & Sons, Dubuque, Ia.
F. M. Turner, Dayton, O
John Wharton Maxcy,. Houston, Tex.

BUSINESS DIRECTORY—CONTINUED.

Consulting Forester.
F. E. Meier, New York City.

Contractors.
Andrews Asphalt Paving Co., Hamilton, O.
T. J. Backus Construction Co., Dayton, O.
Jas. H. Baker & Sons, Port Huron, Mich.
Rudolph S. Blome Co., Chicago, Ill.
Central Paving Co., Chicago, Ill.
City Wastes Disposal Co., New York City.
Geo. W. Clark, Wausau, Wis.
J. E. Conley & Co., Dayton, O.
Geo. W. Fife, Indianapolis, Ind.
Gilsonite Construction Co., St. Louis, Mo.
Hoosier Construction Co., Indianapolis, Ind.
Indiana Paving Brick & Block Co., Indianapolis, Ind.
L. T. McFarland, Van Wert, O.
J. E. Salfisberg & Co., Aurora, Ill.
Sanitary Sewer Construction Co., Jackson, Mich.
John A Spencer, Grinnell, Ia.
H. P. Streicher & Co., Toledo, O.
A. D. Thompson, Peoria, Ill.
M. Tschirgi & Sons, Dubuque, Ia.

Contractors' Supplies.
The F. Bissell Co., Toledo, O.
Ohio Quarries Co., Cleveland, O.
Portsmouth Machine & Casting Co., Portsmouth, O.
Standard Asphalt & Rubber Co., Chicago, Ill.
St. Louis Crushed Quartz Co., St. Louis, Mo.
Schaeffer & Gengnagle, Dayton, O.
A. & S. Wilson, Pittsburg, Pa.

Contractors' Tools and Machinery.
Austin & Western Co., Ltd., Chicago, Ill.
The Conneaut Shovel Co., Conneaut, O.
Contractors' Tool Company, Philadelphia, Pa.
Koehring Machine Co., Milwaukee, Wis.
W. M. Toy & Co., Sidney, O.

Contractors' Wagons.
Studebaker Bros. Mfg. Co., South Bend, Ind.
Troy Wagon Works Co., Troy, O.
D. S. Watson, Canastota, N. Y.

Conveyors.
Browning Engineering Co., Cleveland, O.
Carson Trench Machine Co., Boston, Mass.
The Jeffrey Mfg. Co., Columbus, O.
Link Belt Engineering Co., Philadelphia, Pa.

Creosote.
F. J. Lewis Mfg. Co., Moline, Ill.
Republic Chemical & Creosoting Co., Indianapolis, Ind.
U. S. Wood Preserving Co., New York City.

Creosoted Wood Block.
Kettle River Quarries Co., Minneapolis, Minn.
Republic Chemical and Creosoting Co., Indianapolis, Ind.
U. S. Wood Preserving Co., New York City.

Crushers, Rock and Ore.
Austin & Western Co., Ltd., Chicago, Ill.
Geo. V. Cresson Co., Philadelphia, Pa.
Jeffrey Mfg. Co., Columbus, O.

Crushed Stone.
Cleveland Stone Co., Chicago, Ill.
Flint Stone Co., Toledo, O.
Ohio Quarries Co., Cleveland, O.
St. Louis Crushed Quarts Co., St. Louis, Mo.

Culvert Pipe.
Canton Culvert Co., Canton, O.
R. C. McWane, New York City.
Miracle Pressed Stone Co., Minneapolis, Minn.

Culvert Pipe, Cast Iron.
Felts & East, Lima, O.
R. C. McWane, New York City.

Culvert Pipe, Vitrified.
W. E. Dee Clay Mfg. Co., Chicago, Ill.
Buckeye Fire Clay Co., Uhrichville, O.
East Ohio Sewer Pipe Co., Irondale, O.
Michigan Sewer Pipe Co., Jackson, Mich.
H. Stevens' Sons Co., Macon, Ga.
Terre Haute Brick & Pipe Co., Terre Haute, Ind.

Culverts.
Canton Culvert Co., Canton, O.
R. C. McWane, New York City.
Miracle Pressed Stone Co., Minneapolis, Minn.

Curbing.
R. S. Blome Co., Chicago, Ill.
Cleveland Stone Company, Cleveland, O.
Ft. Scott Stone & Constr. Co., Ft. Scott, Kan.
Ohio Quarries Co., Cleveland, O.
Steel Protected Concrete Co., Philadelphia, Pa.
Warren Bros. Co., Boston, Mass.

Dies.
Portsmouth Machine & Casting Co., Portsmouth, O.

Drain Tile.
Boone Brick, Tile & Paving Co., Boone, Ia.
W. E. Dee Clay Mfg. Co., Chicago, Ill.
Michigan Paving Brick Co., Saginaw, Mich.
Michigan Sewer Pipe Co., Jackson, Mich.

Dryers.
Atlas Dryer Co., Cleveland, O.
F. D. Cummer & Son Co., Cleveland, O.
Iroquois Iron Works, Buffalo, N. Y.
Ruggles-Coles Engineering Co., New York City.

Dump Wagons.
Black Mfg. Co., Chicago, Ill.
Studebaker Bros. Mfg. Co., South Bend, Ind.
Troy Wagon Works Co., Troy, O.
Watson Wagon Co., Canastota, N. Y.

Duplex Brick Clamp.
Duplex Foundry and Mfg. Co., Cleveland, O.

Dust Layers.
Barrett Mfg. Co., New York City.
Indiana Refining Co., Cincinnati, O.

Dust Laying Compound.
Barrett Mfg Co., New York City
Impervious Product Co., Baltimore, Md.
Indiana Refining Co., Cincinnati, O.
F. J. Lewis Mfg. Co., Moline, Ill.
Standard Asphalt & Rubber Co., Chicago, Ill.

Egyptian Cement.
Bartlett & Co., Jackson, Mich.

Electrical Engineers.
H. Whitford Jones, Cleveland, O.
Osborn Engineering Co., Cleveland, O.

Electrical Insulation.
Standard Asphalt & Rubber Co., Chicago, Ill.

Electrolytic Investigations.
Dabney H. Maury, Peoria, Ill.

Engineering Instruments.
Bausch-Lomb Optical Co., Rochester, N. Y.
Lufkin Rule Co., Saginaw, Mich.

Expansion Joints.
A. L. Holmes, Grand Rapids, Mich.
Standard Asphalt & Rubber Co., Chicago, Ill.

Expanded Metal Construction.
R. S. Blome Co., Chicago, Ill.
Expanded Metal & Corrugated Bar Co., St. Louis, Mo.

Filler.
American Asphaltum & Rubber Co., Chicago, Ill.
Barrett Manufacturing Co., New York City.
Impervious Product Co., Baltimore, Md.
F. J. Lewis Mfg. Co., Moline, Ill.
Standard Asphalt & Rubber Co., Chicago, Ill.
Sun Co., Philadelphia, Pa.

Filler Asphalt.
Standard Asphalt & Rubber Co., Chicago, Ill.

Fire Alarm Telegraph.
Gamewell Fire Alarm Telegraph Co., New York.

Fire Brick.
Clearfield Clay Working Co., Clearfield, Pa.
F. B. Holmes & Co., Detroit, Mich.
Michigan Paving Brick Co., Saginaw, Mich.
Michigan Sewer Pipe Co., Jackson, Mich.
H. Stevens' Sons Co., Macon, Ga.

Fire Clay Products.
Buckeye Fire Clay Co., Urichville, O.
Clearfield Clay Working Co., Clearfield, Pa.
W. E. Dee Clay Mfg. Co., Chicago, Ill.
F. B. Holmes & Co., Detroit, Mich.
Michigan Paving Brick Co., Saginaw, Mich.
Michigan Sewer Pipe Co., Jackson, Mich.
H. Stevens' Sons Co., Macon, Ga.

Fire Proof Construction.
R. S. Blome Co., Chicago, Ill.
Expanded Metal & Corrugated Bar Co., St. Louis, Mo.

Flint-Macadam Pavements.
Diamond Flint Co., Lafayette, Ind.

Floors.
Standard Asphalt & Rubber Co., Chicago, Ill.

Flue Liners.
W. E. Dee Clay Mfg. Co., Chicago, Ill.
Lewis McNutt, Brazil, Ind.

Flush Tanks.
Pacific Flush Tank Co., Chicago, Ill.

Forging-Steel.
Krupp (Thos. Prosser & Son, New York City).

Foundation, Concrete.
R. S. Blome Co., Chicago, Ill.

BUSINESS DIRECTORY—CONTINUED.

Garbage Disposal Plants.
City Wastes Disposal Co., New York City
New York Sewage Disposal Co., New York City.
Power Specialty Co., New York City.

Gas Engineers.
Frank D. Moses, Trenton, N. J.
Wm. D. Marks, New York City.

Gas Lamps.
Royal Gas Light Co., Chicago, Ill.

Gas Pipe.
McWane Pipe Works, New York City.

Gas Works.
Frank D. Moses, Trenton, N. J.

Gasolene Engines.
Waterloo Cement Machinery Co., Waterloo, Iowa

GRANITOID CONCRETE BLOCK PAVEMT
Rudolph S. Blome Co., Chicago, Ill.

Gum Paints and Varnish.
Standard Asphalt & Rubber Co., Chicago, Ill.

Hoisters.
Potter Mfg. Co., Indianapolis, Ind.

Hoisting Machinery.
Jeffrey Mfg. Co., Columbus, O.

Hollow Building Blocks.
Lewis McNutt, Brazil, Ind.

Hydraulic Cement.
Meacham & Wright, Chicago, Ill
Utica Hydraulic Cement Co., Utica, Ill.

Hydrolene.
Sun Co., Philadelphia, Pa.

Impregnating Gums.
Standard Asphalt & Rubber Co., Chicago, Ill.

Inspection of Buildings.
Lehigh Valley Testing Laboratory, Allentown, Pa.
Osborn Engineering Co., Cleveland, O.

Inspection of Structural Materials.
Lehigh Valley Testing Laboratory, Allentown, Pa.
Osborn Engineering Co., Cleveland, O.
H. Whitford Jones, Cleveland, O.

Insulating Gums and Compounds.
Standard Asphalt & Rubber Co., Chicago, Ill.

Insulating Material.
Standard Asphalt & Rubber Co., Chicago, Ill.

Iron Paints.
Standard Asphalt & Rubber Co., Chicago, Ill.

Laboratory.
Lehigh Valley Testing Laboratory, Allentown, Pa.
Meade Testing Laboratories, Nazareth, Pa.
Osborn Engineering Co., Cleveland, O.
Henry S. Spackman Engineering Co., Philadelphia, Pa.

Landscape Engineers.
Mason L. Brown, Detroit, Mich.
F. R. Meier, New York City.

Liquid Asphalt.
Indiana Refining Co., Cincinnati, O.

Lime Kilns.
F. L. Smidth & Co., New York City.

Macadamizing.
Granite City Lime & Cement Co., Granite City, Ill.
Warren Bros. Co., Boston, Mass.

Masons' Supplies.
J. E. Bartlett Co., Jackson, Mich.

Mastic.
Standard Asphalt & Rubber Co., Chicago, Ill.

Mastic Floors.
Standard Asphalt & Rubber Co., Chicago, Ill.

Mechanical Engineers.
Osborn Engineering Co., Cleveland, O.
Dabney H. Maury, Peoria, Ill.

Meters.
Buffalo Meter Co., Buffalo, N. Y.
Simplex Valve and Meter Co., Philadelphia, Pa.

Meter Boxes.
H. W. Clark, Mattoon, Ill.
Ford Meter Box Co., Hartford City, Ind.
Grand Rapids Meter Box Co., Grand Rapids, Mich.

Mineral Rubber.
American Asphaltum and Rubber Co., Chicago, Ill.
F. J. Lewis Mfg. Co., Moline, Ill.
Standard Asphalt & Rubber Co., Chicago, Ill.

Mineral Rubber Pipe Dip & Coatings.
Standard Asphalt & Rubber Co., Chicago, Ill.

Municipal Accounting.
Adolphe Rafter, New York City.

Municipal Lighting.
Barron-Collier Co., Memphis, Tenn.

Name Stamps.
Adjustable Name Stamp Co., Clinton, Wis.

Non-Staining Cement.
Art Portland Cement Co., Kimmell, Ind.
Meachan & Wright, Chicago, Ill.

Paint and Varnish Gums.
Standard Asphalt & Rubber Co., Chicago, Ill.

Paints.
Standard Asphalt & Rubber Co., Chicago, Ill.

Paints, Iron.
Standard Asphalt & Rubber Co., Chicago, Ill.

Pans.
Portsmouth Machine & Casting Co., Portsmouth, O.

Pavements.
Rudolph S. Blome Co., Chicago, Ill.
Standard Asphalt & Rubber Co., Chicago, Ill.

Paving Blocks.
Boone Brick, Tile & Paving Co., Boone, Ia.
Carlyle Paving Brick Co., Portsmouth, O.
Clinton Paving and Building Brick Company, Clinton, Ind.
Danville Brick Co., Danville, Ill.
Flint Brick & Coal Co., Des Moines, Ia.
Kettle River Quarries Co., Minneapolis, Minn.
Logan Brick Mfg. Co., Toledo, O.
McAvoy Vitrified Brick Co., Philadelphia, Pa.
Metropolitan Paving Brick Co., Canton, O.
Michigan Paving Brick Co., Saginaw, Mich.
Peebles Paving Brick Co., Portsmouth, O.
Purington Paving Brick Co., Galesburg, Ill.
Saginaw Paving Brick Co., Saginaw, E. S., Mich.
Springfield Paving Brick Co., Springfield, Ill.
The Wassal Brick Co., Glouster, O.
U. S. Wood Preserving Co., New York City.

Paving Brick.
Boone Brick, Tile & Paving Co., Boone, Ia.
Carlyle Paving Brick Co., Portsmouth, O.
Clearfield Clay Working Co., Clearfield, Pa.
Clinton Paving and Building Brick Co., Clinton, Ind.
Collinwood Shale Brick Co., Collinwood, O.
Danville Brick Co., Danville, Ill.
Flint Brick & Coal Co., Des Moines, Ia.
F. B. Holmes & Co., Detroit, Mich.
Kentucky Vitrified Brick Co., Louisville, Ky.
Logan Brick Mfg. Co., Toledo, O.
McAvoy Vitrified Brick Co., Philadelphia, Pa.
Metropolitan Paving Brick Co., Canton, O.
Michigan Paving Brick Co., Saginaw, Mich.
National Paving Brick Manufacturers Association, Terre Haute, Ind.
Peebles Paving Brick Co., Portsmouth, O.
Purington Paving Brick Co., Galesburg, Ill.
Saginaw Paving Brick Co., Saginaw, E. S., Mich.
Shawmut Mining Co., Shawmut, Pa.
Springfield Paving Brick Co., Springfield, Ill.
Terre Haute Brick and Pipe Co., Terre Haute, Ind.
Wabash Clay Mfg. Co., Veedersburg, Ind.
The Wassal Brick Co., Glouster, O.

Paving Brick Association.
National Paving Brick Manufacturers Association, Terre Haute, Ind.

Paving Brick Machinery.
Atlas Dryer Co., Cleveland, O.
Chambers Bros. Co., Philadelphia, Pa.

Paving Castings.
Portsmouth Machine & Casting Co., Portsmouth, O.

Paving, Cement Sidewalk.
R. S. Blome Co., Chicago, Ill.

Paving Contractors.
Andrews Asphalt Paving Co., Hamilton, O.
T. J. Backus Construction Co., Dayton, O.
Jas. H. Baker & Son, Port Huron, Mich.
Central Paving Co., Chicago, Ill.
Geo. W. Clark, Wausau, Wis.
R. S. Blome Co., Chicago, Ill.
Gilsonite Construction Co., St. Louis, Mo.
Hoosier Construction Co., Indianapolis, Ind.
Indiana Paving Brick and Block Co., Indianapolis, Ind
Sicilian Asphalt Co., New York City.
H. P. Streicher & Co., Toledo, O.
Western Construction Co., Lafayette, Ind.
Warren Asphalt Paving Co., Cambridge, Mass.

BUSINESS DIRECTORY—CONTINUED.

Paving Filler.
Barrett Manufacturing Co., New York City.

Paving Materials.
Granite City Lime & Cement Co., Granite City, Ill.
Standard Asphalt & Rubber Co., Chicago, Ill.

Paving Pitch.
F. J. Lewis Mfg. Co., Moline, Ill.
McAvoy Vitrified Brick Co., Philadelphia, Pa.
Michigan Paving Brick Co., Saginaw, Mich.

Paving Tools.
Adjustable Name Stamp Co., Clinton, Wis.
Contractors' Tool Company, Philadelphia, Pa.
Iroquois Iron Works, Buffalo, N. Y.

Pipe Coatings.
American Asphaltum and Rubber Co., Chicago, Ill.
F. J. Lewis Mfg. Co., Moline, Ill.
Standard Asphalt & Rubber Co., Chicago, Ill.

Pipe Dip.
Standard Asphalt & Rubber Co., Chicago, Ill.

Pipe Dip and Coatings.
Standard Asphalt & Rubber Co., Chicago, Ill.

Pipe Manufacturers.
McWane Pipe Works, New York City.

Pitch.
F. J. Lewis Mfg. Co., Moline, Ill.

Plaster.
J. E. Bartlett Co., Jackson, Mich.

Portland Cement.
Alpha Portland Cement Co., Alpha, N. J.
Alsen's Am. Portland Cement Co., New York City.
Art Portland Cement Co., Kimmell, Ind.
Atlas Portland Cement Co., New York City
J. E. Bartlett Co., Jackson, Mich.
Chicago Portland Cement Co., Chicago, Ill.
Dexter Portland Cement Co., Philadelphia, Pa.
French, Samuel H. & Co., Philadelphia, Pa.
Gabriel & Schall, New York City.
W. G. Hartranft Cement Co., Philadelphia.
F. B. Holmes & Co., Detroit, Mich.
Kansas Portland Cement Co., Iola, Kans.
Kosmos Portland Cement Co., Louisville, Ky.
Lesley & Trinkle, Philadelphia, Pa.
Lehigh Portland Cement Co., Allentown, Pa.
Marquette Cement Mfg. Co., Chicago, Ill.
Meacham & Wright, Chicago, Ill.
Northampton Portland Cement Co., N. Y. City.
Omega Portland Cement Co., Jonesville, Mich.
Peninsular Portland Cement Co., Jackson, Mich
St. Louis Portland Cement Co., St. Louis, Mo
Universal Portland Cement Co., Chicago, Ill
Charles Warner & Co., New York.
Charles Warner Co., Wilmington, Del.
Western States Port. Cem. Co., Independence, Kan.
Wolverine Portland Cement Co., Coldwater, Mich.
Wyandotte Portland Cement Co., Wyandotte, Mich
York Portland Cement Co., Portsmouth, O.

Power Transmission.
Geo. V. Cresson Co., Philadelphia, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link Belt Engineering Co., Philadelphia, Pa

Presses.
Portsmouth Machine & Casting Co., Portsmouth, O.

Railroad Specialists.
Krupp (Thos. Prosser & Son, New York City.)

Reservoirs, Concrete.
R. S. Blome Co., Chicago, Ill.

Road Culverts.
Felts & East, Lima, O.

Road Oils.
Standard Asphalt & Rubber Co., Chicago, Ill.

Road Machinery.
Austin & Western Co., Ltd., Chicago, Ill.
Buffalo Steam Roller Co., Buffalo, N. Y.

Road Rollers.
Austin & Western Co., Ltd., Chicago, Ill.
Buffalo Steam Roller Co., Buffalo, N. Y.
Enterprise Mfg. Co., Columbiana, O.
Erie Machine Shop, Erie, Pa.
Iroquois Iron Works, Buffalo, N. Y.
Kelley-Springfield Road Roller Co., Springfield, O.

Rock Crushers.
Austin & Western Co., Ltd., Chicago, Ill
Jeffrey Mfg. Co., Columbus, O.

Rock Drills.
Jeffrey Mfg. Co., Columbus, O.

Roofing.
F. J. Lewis Mfg. Co., Moline, Ill.
Standard Asphalt & Rubber Co., Chicago, Ill.
Warren Brothers Company, Boston, Mass.

Roofing Material.
American Asphaltum & Rubber Co., Chicago, Ill.
F. J. Lewis Mfg. Co., Moline, Ill.
Standard Asphalt & Rubber Co., Chicago, Ill.
Warren Brothers Company, Boston, Mass.

Rope Transmission.
Geo. V. Cresson Co., Philadelphia, Pa.
The Jeffrey Mfg. Co., Columbus, O.

Sand.
Granite City Lime & Cement Co., Granite City, Ill.

Sand Dryers.
F. D. Cummer & Son, Cleveland, O.

Sanitary Engineers.
New York Sewage Disposal Co., New York City.

Sarco.
Standard Asphalt & Rubber Co., Chicago, Ill.

Scrapers.
Austin & Western Co., Chicago, Ill.
W. M. Toy & Co., Sidney, O.

Screens.
Portsmouth Machine & Casting Co., Portsmouth, O.

Sewage Disposal.
City Wastes Wastes Disposal Co., New York City.
New York Sewage Disposal Co., New York City.
Power Specialty Co., New York City.

Sewer Braces.
Kalamazoo Foundry & Machine Co., Kalamazoo, Mich.
The Potter Mfg. Co., Indianapolis, Ind.

Sewer Castings.
Portsmouth Machine & Casting Co., Portsmouth, O.

Sewer Contractors.
T. J. Backus Construction Co., Dayton, O.
The Potter Mfg. Co., Indianapolis, Ind.
Sanitary Sewer Construction Co., Jackson, Mich.
H. P. Streicher & Co., Toledo, O.

Sewer Machines.
Potter Mfg. Co., Indianapolis, Ind.

Sewer Pipe.
P. Bannon Sewer Pipe Co., Louisville, Ky.
Buckeye Fire Clay Co., Urichsville, O.
W. E. Dee Clay Mfg. Co., Chicago, Ill.
F. B. Holmes & Co., Detroit, Mich.
Lewis McNutt, Brazil, Ind.
Michigan Sewer Pipe Co., Jackson, Mich.
Reinforced Concrete Pipe Co., Jackson, Mich.
Schaeffer & Gengnagel, Dayton, O.
H. Stevens' Sons Co., Macon, Ga.

Sewer Rods.
The F. Bissell Co., Toledo, O.

Sewer Trap.
Perfect Sewer Trap Mfg. Co., New York City.

Sheet Contractors' Supplies.
Standard Asphalt & Rubber Co., Chicago, Ill.

Shovels.
The Conneaut Shovel Co., Conneaut, O.

Sidewalk Tools.
Waterloo Cement Machinery Co., Waterloo, Iowa.

Sprinkling Wagons.
Austin & Western Co., Ltd., Chicago, Ill.
E. D. Etnyre & Co., Oregon, Ill.
Studebaker Bros. Mfg. Co., South Bend, Ind.

Standard Rattlers.
Tinius Olsen & Co., Philadelphia, Pa.

Steel Centerings.
Adjustable Steel Centering Co., Fond du Lac, Wisc.

Steel Tape.
Lufkin Rule Co., Saginaw, Mich.

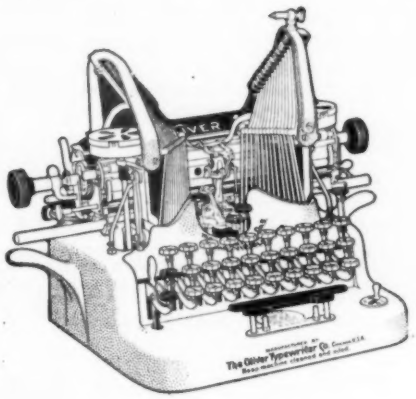
Stone Pavements.
Cleveland Stone Co., Cleveland, O.
Flint Stone Co., Toledo, O.

Street Contractors' Supplies.
Austin & Western Co., Ltd., Chicago, Ill.
J. S. Barron, New York City.
Iroquois Iron Works, Buffalo, N. Y.
Kelly-Springfield Road Roller Co., Springfield, O.

Street Crossings.
Cleveland Stone Co., Chicago, Ill.
Street Lighting.
Barron-Collier Co., Memphis, Tenn.
Street Scrapers.
Austin & Western Co., Ltd., Chicago, Ill.
W. M. Toy & Co., Sidney, O.
Street Sweepers.
Austin & Western Co., Ltd., Chicago, Ill.
J. S. Barron, New York City.
Studebaker Bros. Mfg. Co., South Bend, Ind.
Surveyors' Instruments.
Bausch-Lomb Optical Co., Rochester, N. Y.
Surveyors.
The Brotherton Co., Escanaba, Mich.
Taroline.
F. J. Lewis Mfg. Co., Moline, Ill.
Tarvia.
Barrett Mfg. Co., New York City.
Testing Chemists.
Dow & Smith, New York City.
Lehigh Valley Testing Laboratory, Allentown, Pa.
Meade Testing Laboratories, Nazareth, Pa.
Henry S. Spackman Engineering Co., Philadelphia, Pa.
Testing Laboratories.
R. W. Hunt & Co., Chicago, Ill.
Lehigh Valley Testing Laboratory, Allentown, Pa.
Meade Testing Laboratories, Nazareth, Pa.
Osborn Engineering Co. Cleveland, O
Henry S. Spackman Engineering Co., Philadelphia, Pa.
Tinius Olsen & Co., Philadelphia, Pa.
Testing Machinery.
Tinius Olsen & Co., Philadelphia, Pa.
Transmission Outfits.
Geo. V. Cresson Co., Philadelphia, Pa.
The Jeffrey Mfg. Co., Columbus, O.
Trench Machines.
The Potter Mfg. Co., Indianapolis, Ind
Tube Mills.
Krupp (Thos. Prosser & Son, New York City.)
F. L. Smidth & Co., New York City.
Valves.
Simplex Valve and Meter Co., Philadelphia Pa.
Varnish Gums.
Standard Asphalt & Rubber Co., Chicago, Ill.
Water Pipe.
McWane Pipe Works, New York City.
Water Pipe Joints.
A. L. Holmes, Grand Rapids, Mich.
Waterproofing.
American Asphaltum & Rubber Co., Chicago, Ill.
Sandusky Portland Cement Co., Sandusky, O
Standard Asphalt & Rubber Co., Chicago, Ill.
Waterproofing for Cement.
Standard Asphalt & Rubber Co., Chicago, Ill.
Waterproofing for Concrete.
Standard Asphalt & Rubber Co., Chicago, Ill.
Water Meters.
Buffalo Meter Co., Buffalo, N. Y.
Simplex Valve and Meter Co., Philadelphia Pa.
Water Meter Boxes.
H. W. Clark, Mattoon, Ill.
Grand Rapids Meter Box Co., Grand Rapids Mich.
Waterworks Supplies.
Buffalo Meter Co., Buffalo, N. Y.
McWane Pipe Works, New York City.
Wheelbarrows.
Austin & Western Co., Ltd., Chicago, Ill
Portsmouth Machine & Casting Co., Portsmouth, O.
Wheel Scrapers.
Austin & Western Co., Ltd., Chicago, Ill.
White Portland Cement.
Art Portland Cement Co., Kimmell, Ind.
Wire Screens.
Portsmouth Machine & Casting Co., Portsmouth, O.
Wood Pavements.
Kettle River Quarries Co., Minneapolis, Minn
Republic Chemical & Creosoting Co., Indianapolis, Ind.
U. S. Wood Preserving Co., New York City
Wood Preservatives.
F. J. Lewis Mfg. Co., Moline, Ill.
Wood Split Pulley.
The Jeffrey Mfg. Co., Columbus, O

New Oliver No. 5

Sets Swiftest Pace Ever Known in Typewriter Selling



The wonderful new model, Oliver No. 5, has taken the market by storm.

Its reception by the public has exceeded in enthusiasm any thing we had dared to anticipate.

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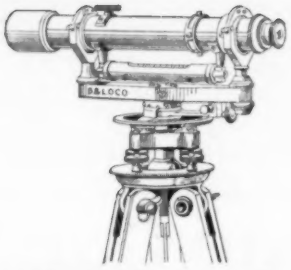

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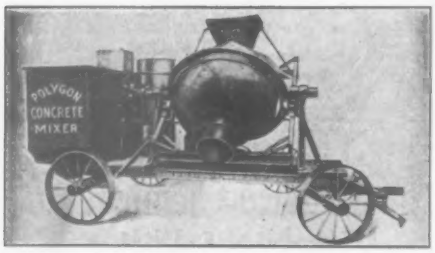

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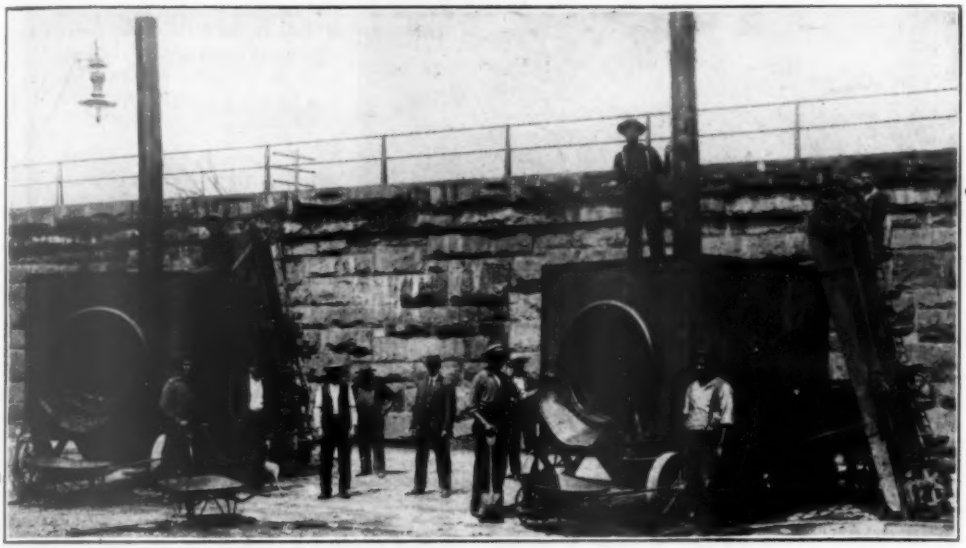

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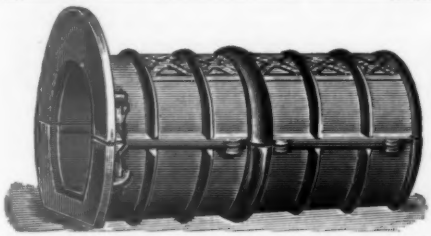

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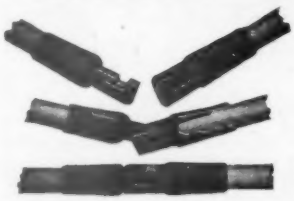

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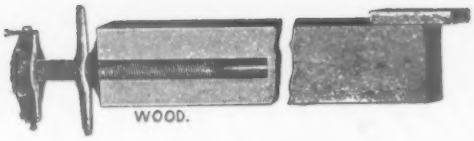

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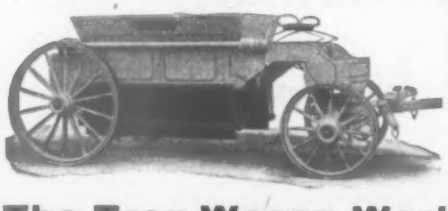

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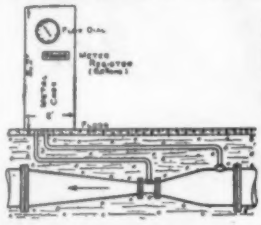

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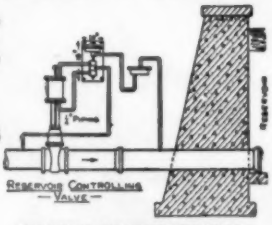

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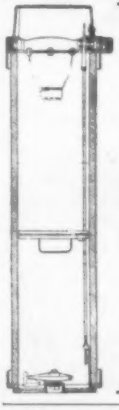

A COMPLETE METER BOX

Among the many other points of excellence which the Ford Meter Box enjoys over all other makes is the fact that it is complete in itself. It requires not one cent of expense nor one minute's time to prepare it for its meter. It is adjustable to different makes of meters and is the most thorough protection from surface water, frost and all other damaging influences. It is light, durable and made by an experienced water works man to meet every requirement. Saves money and annoyance.

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FORD METER BOX COMPANY

112 SOUTH HIGH STREET, HARTFORD CITY, IND.

BUILDERS IRON FOUNDRY, Providence, R. I., Sales Agents for New England

INFRINGEMENT NOTICE

THE CLARK METER BOX has met with wonderful success. Is it any wonder that it is Imitated? Our boxes are now in use throughout the entire country and they are giving perfect satisfaction everywhere. Thousands in use by THE UNITED STATES GOVERNMENT.

We wish to advise our many friends and patrons that our goods are well protected by patents and institution of legal proceedings have been commenced to protect our rights. All infringing MANUFACTURERS and USERS will be prosecuted to the fullest extent of the law.

Let us tell you about our IRON COLLAPSIBLE FORM for the manufacture of CONCRETE METER BOX Bodies, at one-fourth the cost of any other box body. Our TEKSAGON (No Gasket) Meter Coupling is a wonder. Costs no more than ordinary coupling.

Drop us a postal card for catalogue.

H. W. CLARK CO., 1512 Broadway, Mattoon, Ill.

BOXES FOR WATER METERS

We make a complete and finished meter box, including all pipes in place and meter connections, frostproof, air-tight, water-proof, for $3.00.

Durable—no expense to maintain—easily accessible for reading or removing the meter; protected from interference or injury.

WRITE US

THE GRAND RAPIDS METER BOX CO.

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ACCURATE AND DURABLE

WATER METERS

with standard six-hand or straight reading dials, indicating in cubic feet, gallons or liters. Also meters for fuel oil, or other liquids.

BUFFALO METER CO.

290 Terrace, Buffalo, N. Y.

ESTABLISHED 1892.

Barrett's PAVING PITCH

DEXTER STREET, CINCINNATI, SHOWING PITCH-FILLED PAVEMENT

A Pitch Filled Pavement of brick or stone on a proper foundation will never crack, never be undermined, never change its general contour, never bulge, never be damaged by frost, never be slippery.

Filling with pitch costs much less than asphalt, which is non-adhesive and much more satisfactory than cement grout, whose failure to provide for expansion means disaster sooner or later.

Barrett's Paving Pitch Filler is so plastic that it fills all interstices tightly under all conditions of expansion or contraction, adhering perfectly to the blocks and forming an absolutely water-tight and permanent seal. The foundation is thus protected against water and frost. Expansion is taken up just where it ought to be—namely, at every joint instead of by the rather clumsy and inefficient method of widely separated "expansion joints," which are necessary with a cement filler. The pitch-filled joints are all slightly open at the top, affording a series of grooves that are wide enough to give grip to horses' shoes without allowing too much wear on the edges of the brick or making the street rough and noisy under traffic.

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NOISELESS BRICK PAVEMENT

Sarco is an elastic, rubbery filler which prevents wear on the edges and corners of the brick. Increases the life, decreases maintenance cost.

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LIQUID ASPHALT Makes Dustless Roadways

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No Mud
Water-Proof

Sanitary
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Our printed matter contains important paving facts. Write for it today.

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Capacity—40,000 tons per year. 99.6 per cent. bitumen.

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EXCEL THE ARTIFICIAL
UNAFFECTED BY WATER
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Wears Longer Than Man-Made Asphalts and Coal Tar

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ASPHALTED
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Contractors for High-grade Natural Asphalt Pavements.
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Pipe Dip
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SUCCESSFULLY USED OVER TEN YEARS

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PAVING CEMENT

Is the only paving cement on the market that will produce bituminous streets that are unaffected by water and weather conditions.

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Shows its superiority in the "how" and the "where" of the making. That is, every gallon of Bitu-Mineral Cement is manufactured with the greatest care by the most modern and scientific method.

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Enables contractors in all parts of the country to build the most durable bituminous streets at proper, not unreasonable prices. Contractors and municipal authorities should write and learn of the unhampered opportunities they now have to build Bitu-Mineral and other approved forms of bituminous macadam pavements at a minimum first cost.

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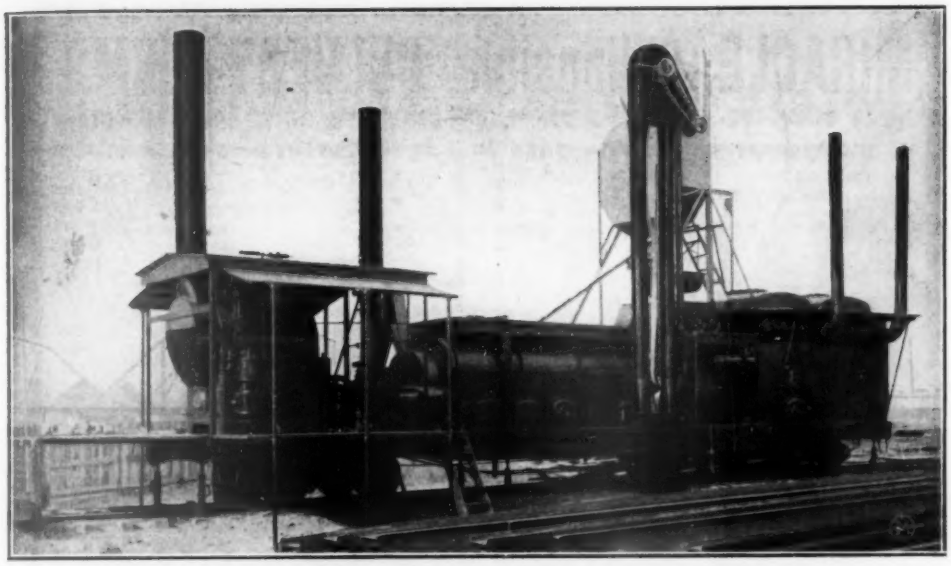

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The Only Profitable Portable Plant Proposition

Complete on One Car

Selling fast as we can turn them out. No failures.
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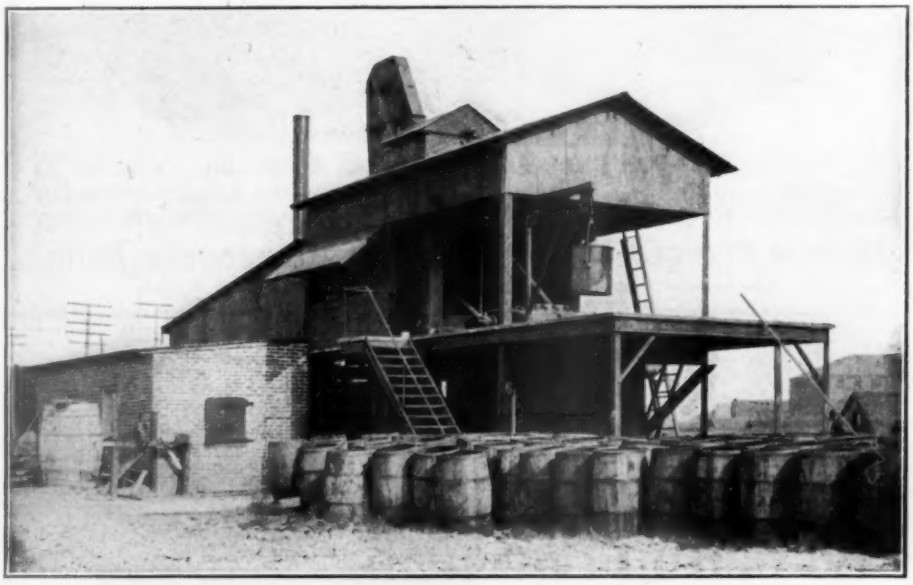

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Here is a Little Wonder. Five Hundred Yards per Day Capacity for Patching

When you deal with us you get from **First Hands.** We own and operate our own steel works, foundry, pattern shop and machine shops. We have facilities and experience not to be found elsewhere

You Pay ONE PROFIT. Cheapest as well as BEST. All Kinds and Any Capacity

MIRACLE (Collapsible) CULVERT FORMS

BUILD CULVERTS CHEAPER THAN PLANK, CLAY PIPE OR CORRUGATED IRON

COMPARATIVE COST OF 4 KINDS OF 16-FOOT CULVERTS, 24 IN. DIAM.

CONCRETE	PLANK	CLAY PIPE	CORRUGATED IRON PIPE
72 cubic feet requires 12 bags of Cement (3 barrels) at $2 . $6.00 32 sq. feet 3-in. mesh No. 16 gauge Expanded Metal at 4c 1.28 $7.28	242 feet 2-in. Lumber, at $35.00 per M, cost $8.00	16 feet Vitrified Clay Pipe, 24 inches in diameter, at $1.35 per foot . . . $21.60	16 feet Corrugated Iron Pipe, at $1.58 per foot . . . $25.28

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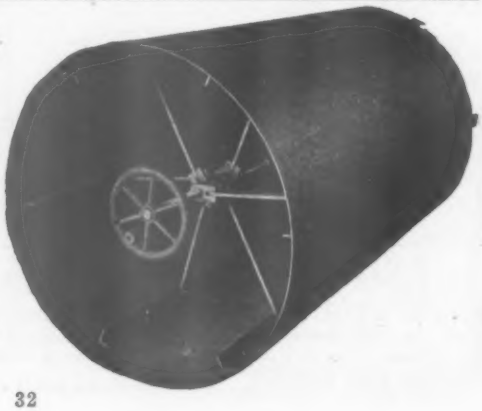

ABOUT RUST

This is the top section of a Cast Iron Lighthouse just completed at our foundry for the United States Government.

Now you wonder what connection this has with Culvert Pipe.

Well, here it is.

A Lighthouse should be as permanent as the rock on which it stands. It must not only endure the ceaseless blows from old ocean's waves and the mighty sweep of the winter winds, but it must resist that most powerful of all destroying elements—**RUST.**

Years of experience has taught our Government Engineers that cast iron is the only material of moderate cost in the mineral kingdom that will do this. If steel or wrought iron would do it, they would use these, because the same tensile strength can be secured at less cost, but they **know** these materials will not last.

Here is a simple problem in arithmetic your seven-year-old boy can work—not a table of "analysis" that only a graduate chemist can understand—

If a corrugated metal culvert 1-16 inch thick will last twenty-five years (note the **IF**), how long will a cast iron culvert 1-2 inch thick (eight times as thick) last?

And the small difference in price will surprise you.

I offer you a Culvert, the life of which has never been measured. It is cheap because it is **LIGHT** and it **LASTS.** It is strong because it is reinforced.

"The reason is in the ribs."

LET ME QUOTE YOU PRICES

R. C. McWANE

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FROM ALL OVER THE

United States

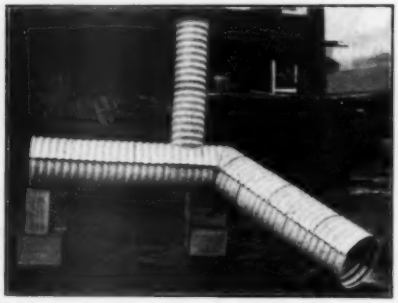
(AND IN SOME FOREIGN COUNTRIES)

THE PEOPLE ARE BUYING

"ACME"

Corrugated Metal Culverts

BECAUSE THEY ARE BEST



Section of "Acme" Culvert Forming a Sewerage System in a Town in Vermont

"Acme" Culverts are the embodiment of everything farthest advanced and best in Culvertdom.

Note their adaptability for various purposes; send your specifications and get our prices on special construction work. Our facilities are equal to any requirement.

Our product and our prices must be right or we wouldn't be selling order after order to people all over the United States.

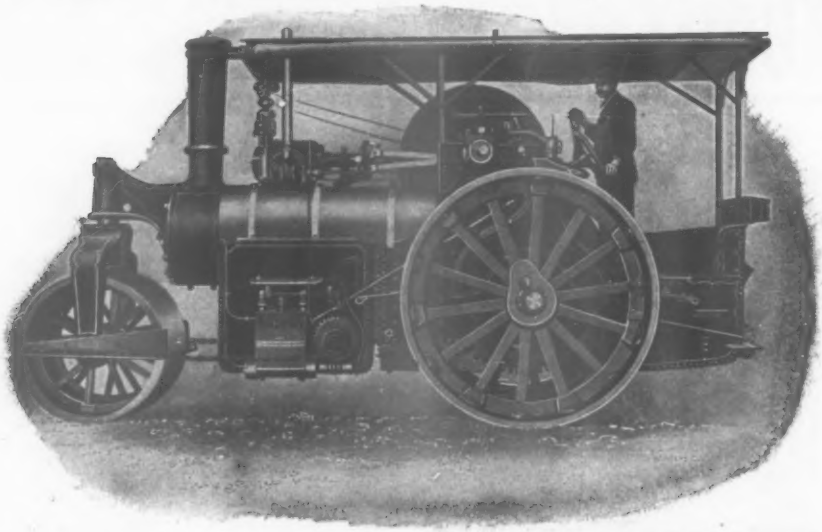
You want to learn all you can about Culverts before buying. Write for Illustrated Booklet "M2" and you'll be in position to form an intelligent opinion regarding the merits of "Acme" Culverts. Write today—before you forget.

A 168-Foot, 60-Inch "Acme" Culvert Installed in an Ohio City

The Canton Culvert Company

Sole Manufacturers **CANTON, OHIO, U. S. A.**

THE KELLY-SPRINGFIELD ROAD ROLLER CO.



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OVER FIFTEEN HUNDRED IN USE. SATISFACTION GUARANTEED.
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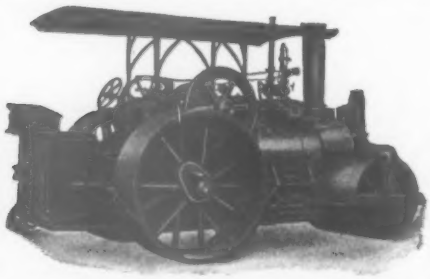

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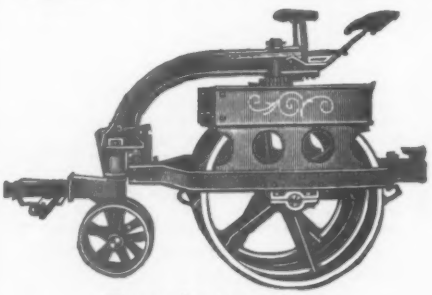

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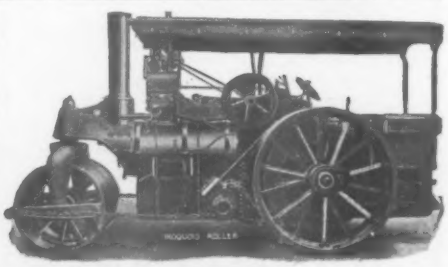

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Portable Concrete Mixers, Asphalt Machinery and Tools. *Send for Catalogue*

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The American Motor Road Roller

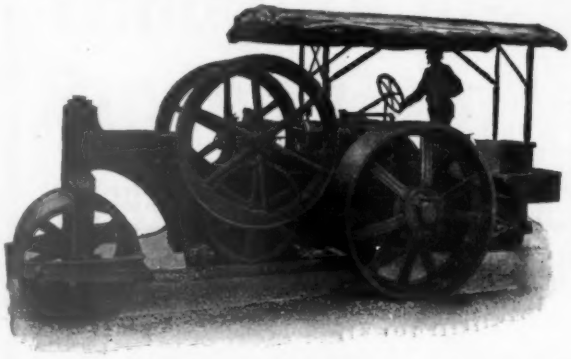
THE FIRST MOTOR ROAD ROLLER EVER MADE IN AMERICA.

An American roller, made in an American factory, by American workingmen.

Made in Four Sizes:

7 TONS : 10 TONS : 12 TONS : 15 TONS

It can do anything and everything which the very best type of Steam Roller can do. It can do it more easily, more efficiently, more economically and less objectionably



Operated by gasoline or denaturized alcohol.

These rollers are in the service of Counties, Cities, Townships, Villages, and Road Contractors from the ATLANTIC to the PACIFIC, from CANADA to MEXICO.

They have reduced cost of operation on an average 30 per cent. and show *maximum efficiency* in work done.

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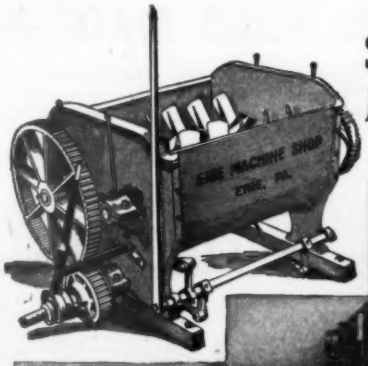

Steam Rollers & Asphalt Mixers.

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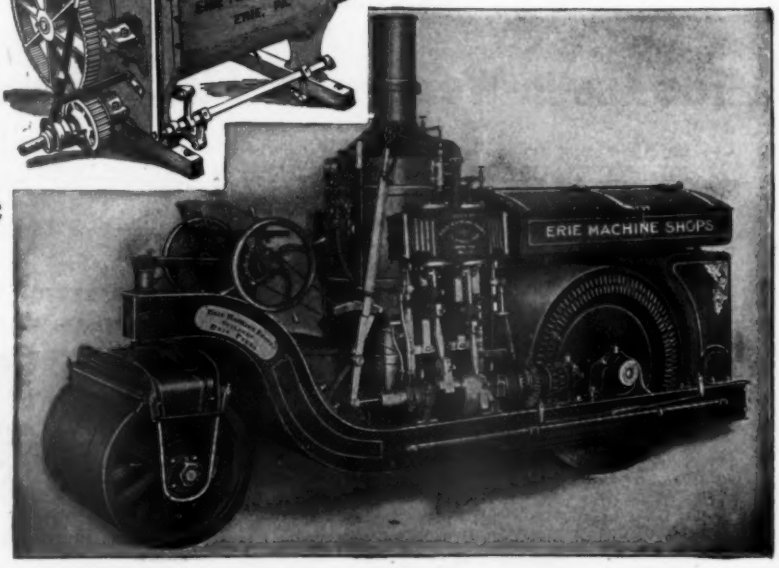

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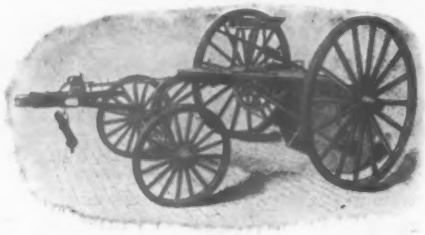

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merit the widespread approval given them:
they are *dependable* in every respect

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AUSTIN-WESTERN ROAD MACHINERY

IN EVERY CORNER

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THE AURORA JAW CRUSHER HAS FEWER PARTS
than any other crusher of similar capacity, consequently
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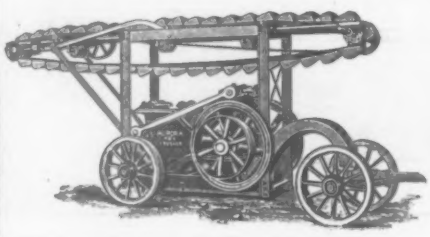
STRENGTH + LIGHTNESS + SIMPLE DUMPING DEVICE =
AUSTIN DUMP WAGON



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A BRIEF THOUGHT ABOUT REPAIRS
A SUGGESTION REGARDING EASY DRAFT

Thoughts for the Man Buying Dump Wagons

If you doubt that Adirondack Birch makes the strongest body for dumping wagons, if you think that other spokes are as good as the second growth, 'A' grade, White Oak spokes we use—just ask men who have used different makes of dump wagons alongside of WATSON'S.

Accidents put Watson Dump Wagons out of commission sometimes—heavy work rarely affects them. All you need in Watson repairing is two hands, a monkey wrench and duplicate part—no long wait at a blacksmith shop.

On the XL Watson Wagon shown here, the design of the front circle will commend itself to you. Easiest draft of any dump wagon in the world.

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WATSON WAGON COMPANY
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Large contractors know the value of Studebaker Dump Wagons

Additional orders for STUDEBAKER DUMP WAGONS are being received continuously from the largest contractors in the country, who find it impossible to duplicate Studebaker quality and who voluntarily testify as to Studebaker superiority. W. H. LUCHTENBURG & COMPANY, Columbus, Ohio, who are extensive contractors, write as follows: "We order your wagons in preference to five others that we have given a thorough trial. These include two of the largest concerns in the country."

Our fifty-six years of experience in wagon construction enables us to build the best Dump Wagon, for all classes of work, that it is possible to produce.

Familiarize yourself with the STUDEBAKER DUMP WAGON, the particulars are interesting, the results convincing. WRITE FOR CATALOG.

Studebaker

Brothers Manufacturing Company
South Bend, Indiana

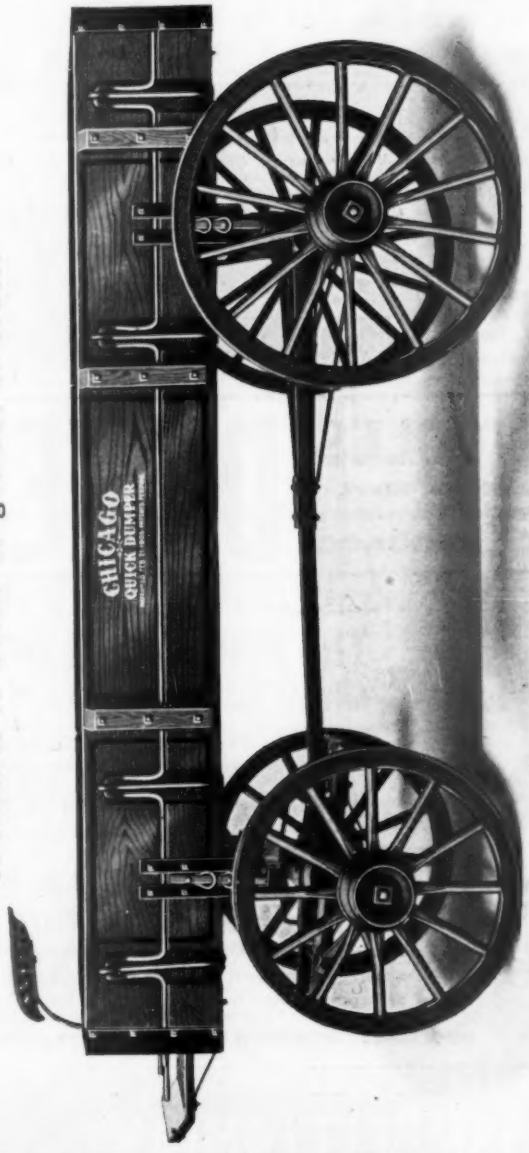
THE CHICAGO QUICK DUMPER

LOW COST
LIGHT DRAFT

USE OLD GEARS
EASY TO OPERATE

OVER FIVE HUNDRED IN USE IN THE CITY OF CHICAGO.

Operated with two levers—easy reach of driver—no chains or rackets to break or get out of order.



With one Chicago Quick Dumper and one of your old gears, you have the best dumping outfit ever made at less than one-third the cost of an ordinary dump wagon.

Made in Sizes 1 to 5 yards. Couples up to 65 inches.

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MANY contractors make a practice of renting all their wagons. Consequently they ge wagons of all sizes and kinds, but mostly slat bottom wagons of small capacity. Now, by purchasing a number of Troy Dump Boxes, which fit any wagon gear, a contractor can convert any rented wagon into a dump wagon at a cost that is nominal compared with the daily saving effected in dumping alone. Besides, the Troy Dump Box has a large capacity, thus increasing the size of loads carried. There are several kinds of dump boxes in the market, but none so simple and strong as the Troy. Send for BULLETIN F and learn why.

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For Sand, Clay, Rock, Marl, All Materials

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DIGS SEWERS, TRENCHES, ETC.
rapidly and cheaply. Write for catalogs.

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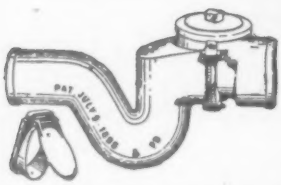

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Will Improve the Sanitary Condition of Any City or Town

Medical advisers recommend it in every home. A perpetual preventive against back water and sewer gas. Architects give it their highest approval.

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The experience of a quarter of a century has convinced the members of the Association that honesty and painstaking care, in every detail in the construction of brick streets, do more than all other influences combined toward inducing property owners and city officials to build more brick streets. In view of this fact, this Association is glad to offer its strong support and hearty co-operation to any contractor who can show satisfactory proof of his ability and purpose to do nothing but first-class work, and who can also show that he is prompt in meeting his financial obligations. Therefore we cordially invite every American Paving Contractor, who STANDS ONLY FOR GOOD WORK AND PROMPT PAY, to file with the office of the Corresponding Secretary full information as to his ability and disposition to come up to the high standard insisted upon by our Association.

Upon application, we mail, free of charge, to any address in the United States or Canada, full specifications which, carefully followed, will result in a street that will convince any fair observer that a brick street has the advantage, considered from every point of view, over any other form of improved pavement. Address

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HIGH-GRADE PAVING BRICK MADE FROM THE FAMOUS SCIOTO SHALES

33% Saved by Using Our Brick Clamp
Write DUPLEX MANUFACTURING & FDRY. CO.
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MANHOLES, CATCH BASIN COVERS, MONUMENT COVERS—A FULL LINE

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Six Factories—Daily Output 500,000

THE METROPOLITAN PAVING BRICK CO.

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We own and operate the finest and one of the largest SANDSTONE plants in Ohio, and make a specialty of machine dressed (something new) and split curbing and sawed flagging. We also furnish BUILDING STONE and GRINDSTONES in any quantity.

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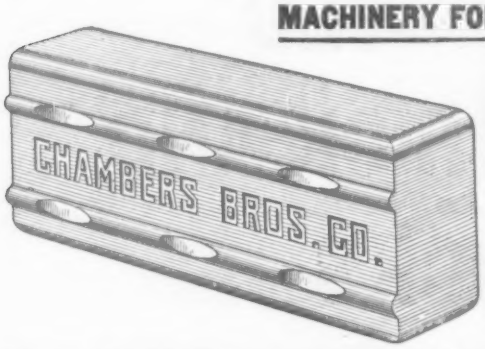

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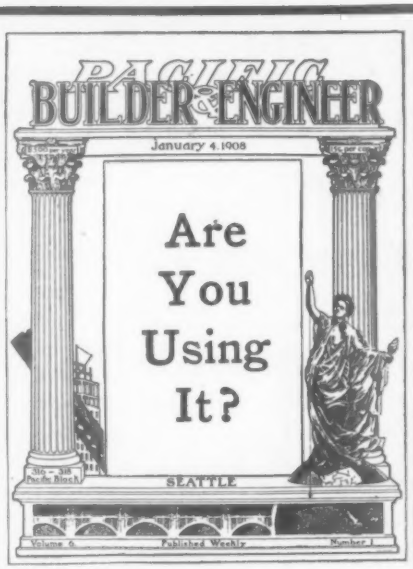

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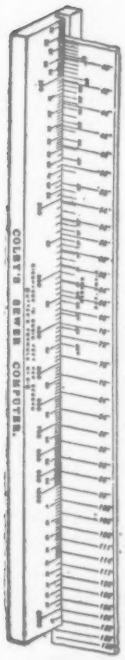

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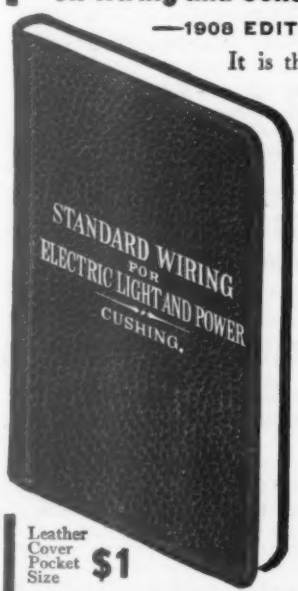

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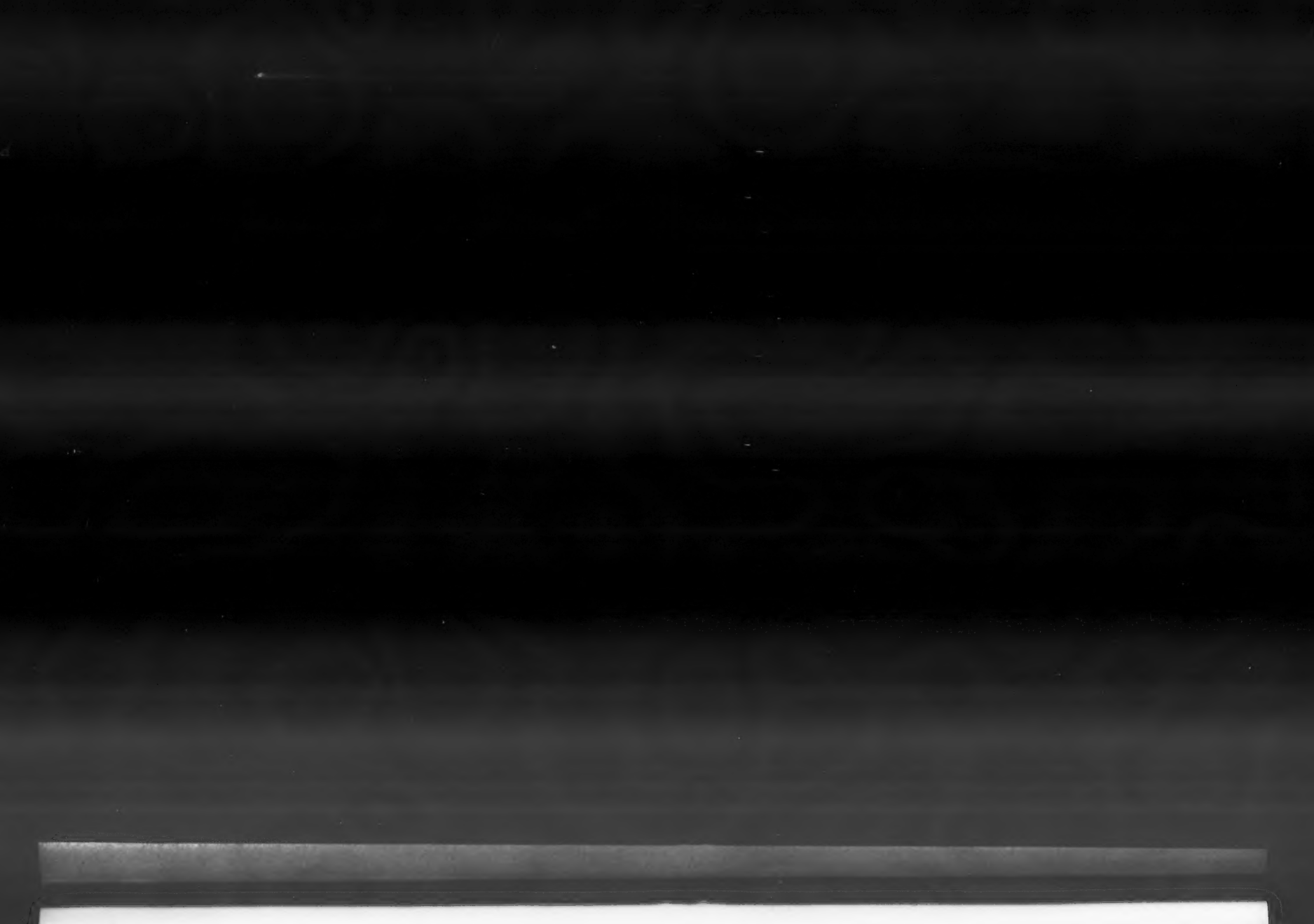

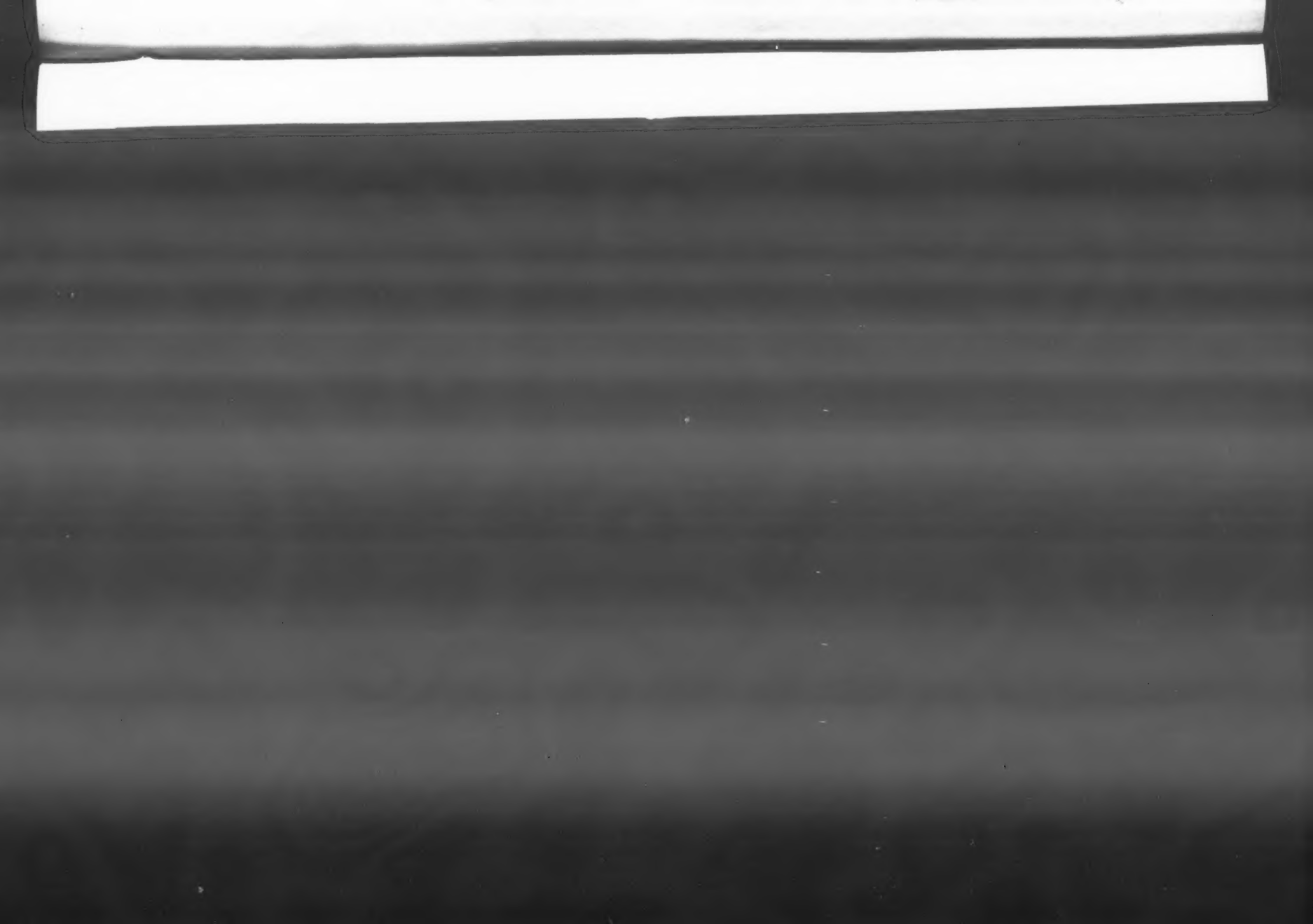

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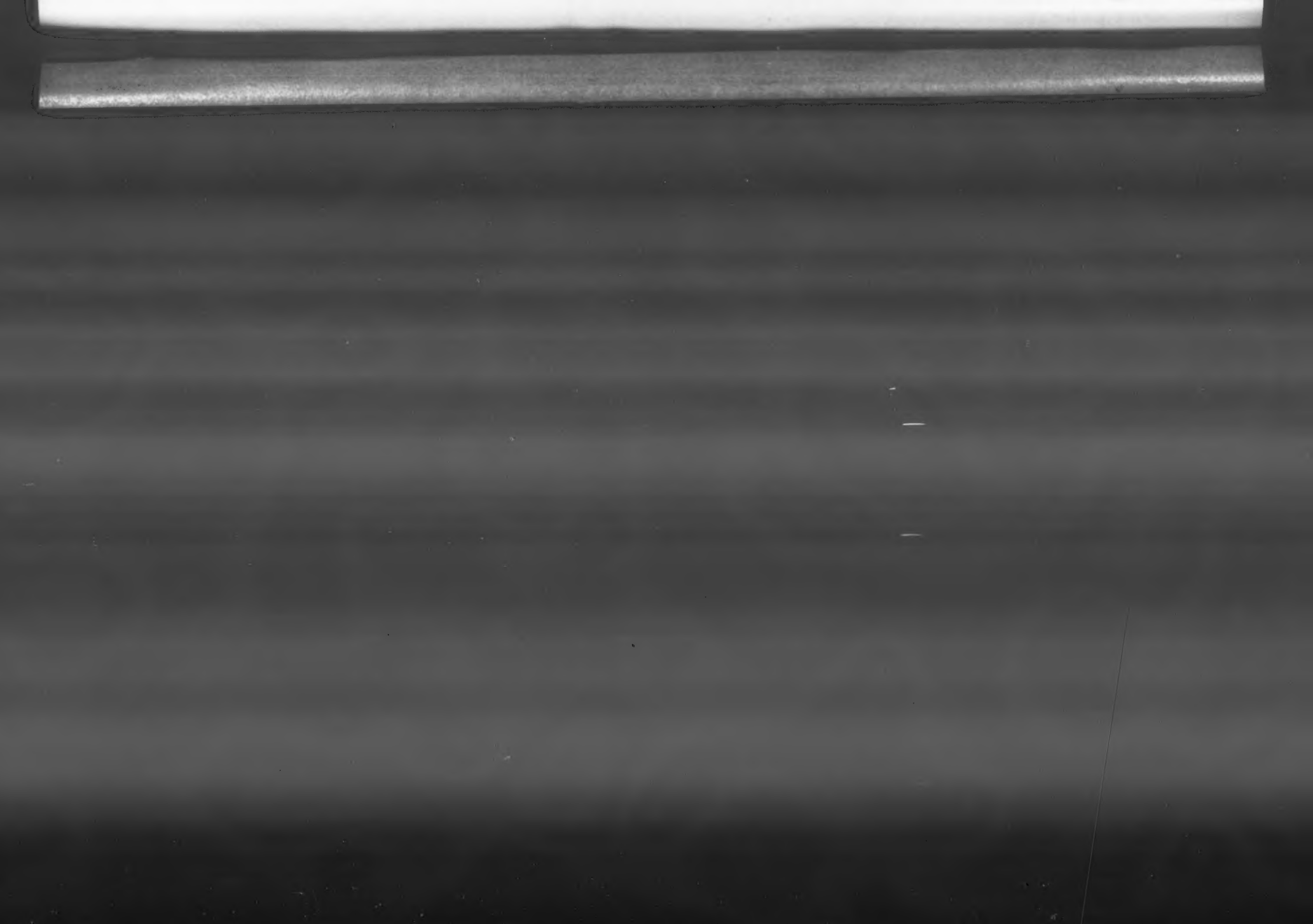

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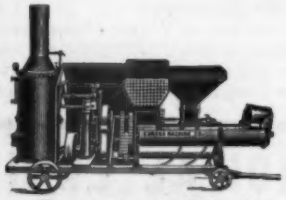

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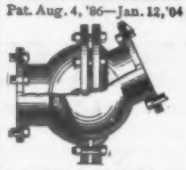

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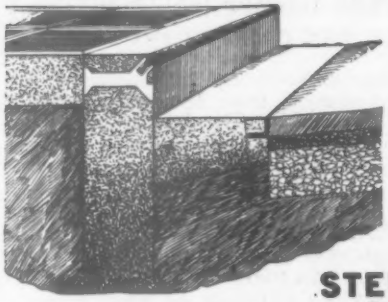

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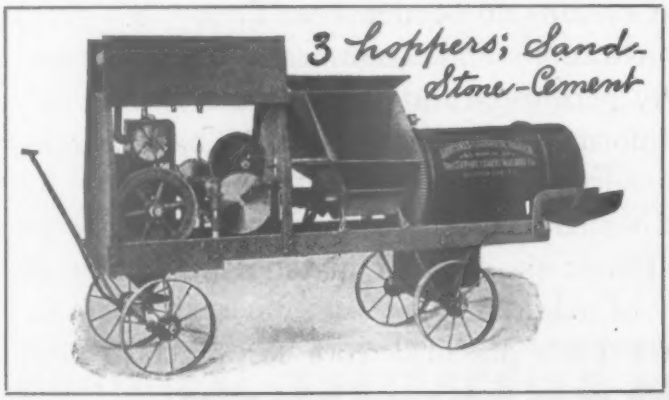

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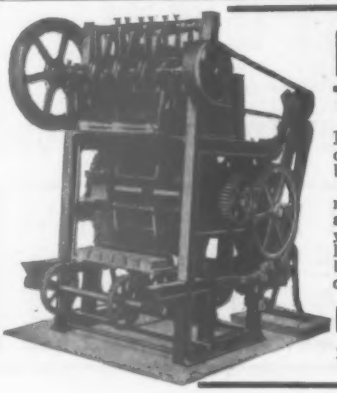

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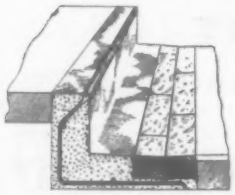

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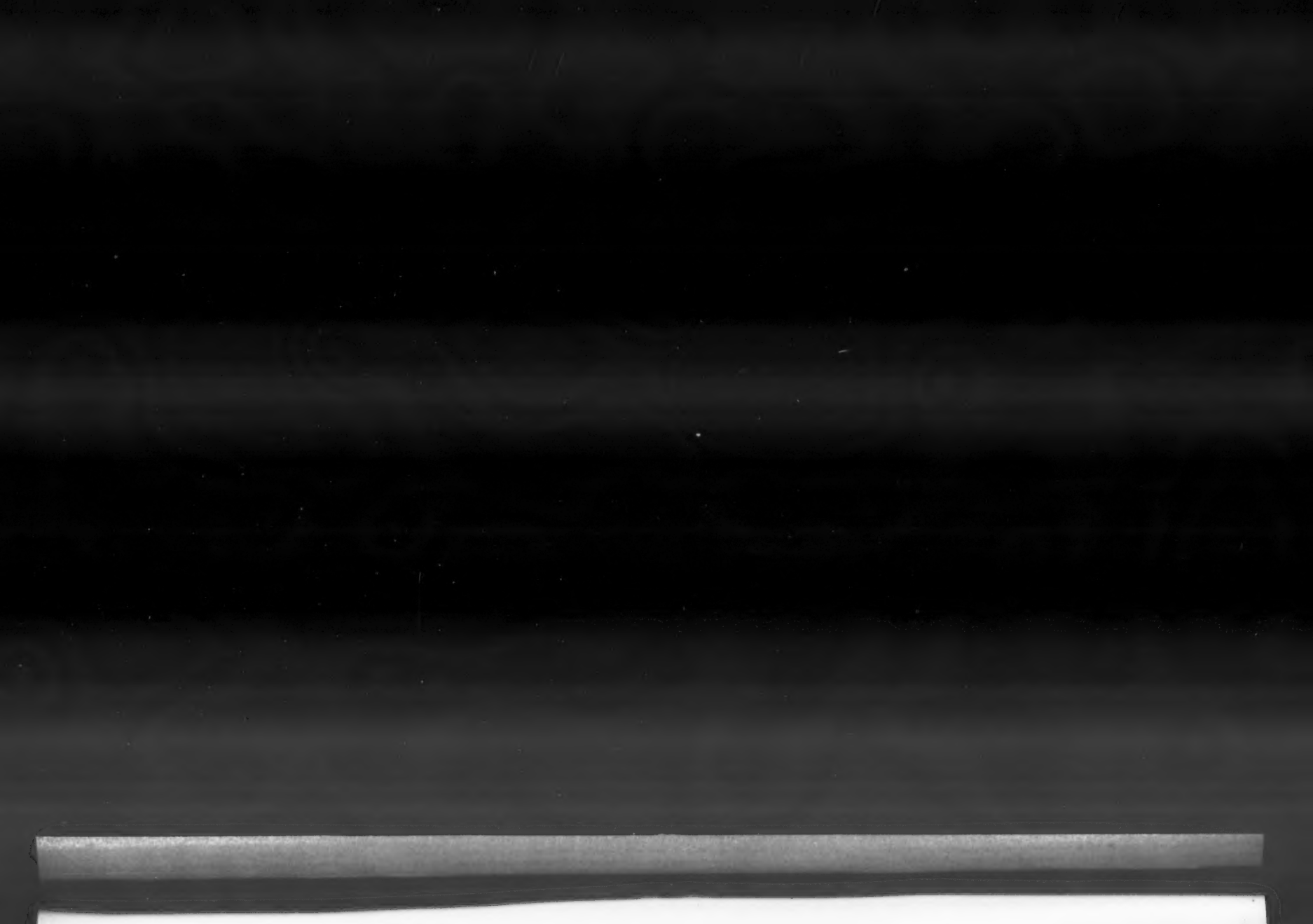

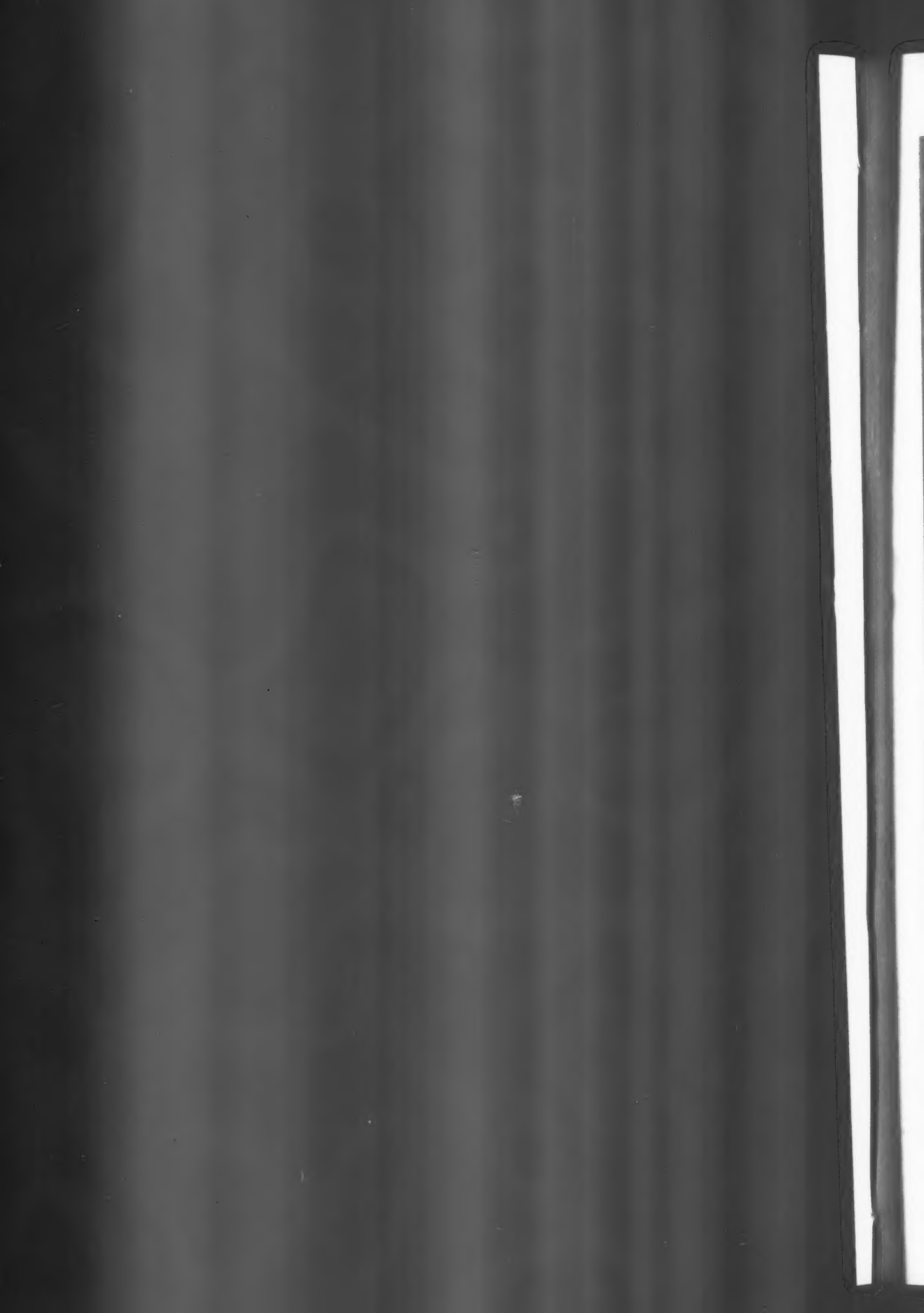

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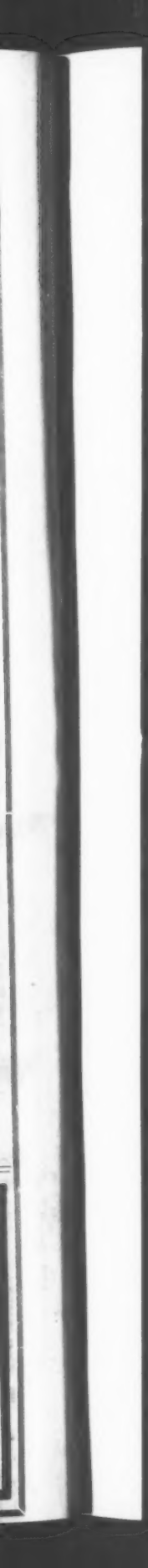

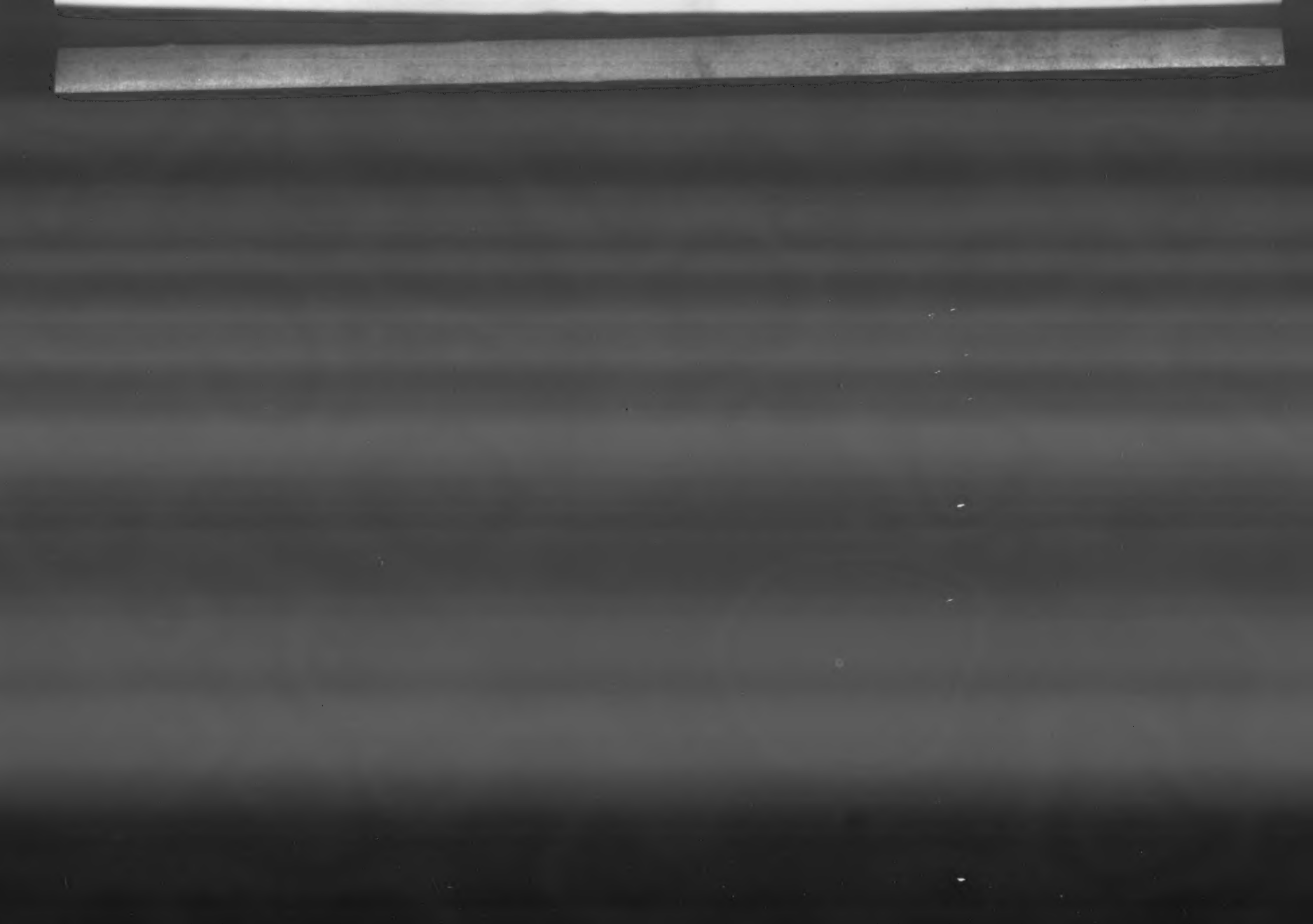

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Gas Works.
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Osborn Engineering Co., Cleveland, O.
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Insulating Material.
Standard Asphalt & Rubber Co., Chicago, Ill.

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Standard Asphalt & Rubber Co., Chicago, Ill.

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Carlyle Paving Brick Co., Portsmouth, O.
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Clinton Paving and Building Brick Co., Clinton, Ind.
Collinwood Shale Brick Co., Collinwood, O.
Danville Brick Co., Danville, Ill.
F. B. Holmes & Co., Detroit, Mich.
Kentucky Vitrified Brick Co., Louisville, Ky.
Logan Brick Mfg. Co., Toledo, O.
Metropolitan Paving Brick Co., Canton, O.
Michigan Paving Brick Co., Saginaw, Mich.
National Paving Brick Manufacturers Association, Terre Haute, Ind.
Peebles Paving Brick Co., Portsmouth, O.
Purington Paving Brick Co., Galesburg, Ill.
Saginaw Paving Brick Co., Saginaw, E. S., Mich.
Shawmut Mining Co., Shawmut, Pa.
Springfield Paving Brick Co., Springfield, Ill.
Terre Haute Brick and Pipe Co., Terre Haute, Ind.
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The Wassal Brick Co., Glouster, O.

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Pitch.
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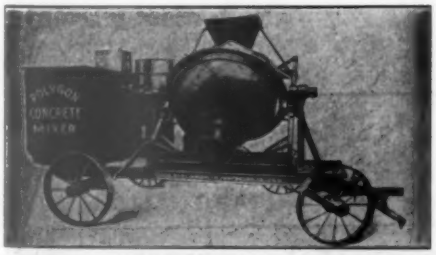

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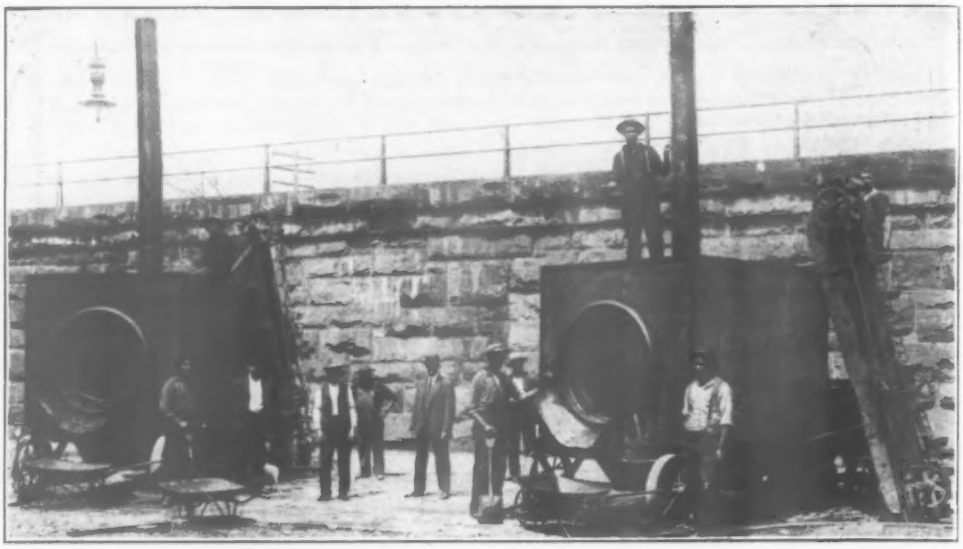

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A great saving is effected in the COST OF WORK in the following way: Instead of carting away the old asphalt surface and hauling new material on the street for resurfacing or repair purposes, break up the old material, dump the same into the mixing drum, adding a small percentage of asphaltic cement to the mass; this is then thoroughly cooked while being mixed and incoporated in the mixer. The mixture is as good as though all new, if not better.

The saving over the old system is threefold and may be enumerated as follows:

1st. Saving of hauling expense of old material.

2nd. Saving of hauling expense of new material to the street that is being repaired.

3rd. But not least, COST of new material for resurfacing or repair work.

One will readily notice from the above what great advantages the Guelich Plant possesses over ALL OTHERS, revolutionizing the asphalt business in that it saves the operator and owner of the plant at least fifty per cent. in the cost of his work.

The Guelich Plant can be operated in winter as well as in summer. We furnish complete formulas with all plants whether for old material or new.

Guelich Portable Asphalt Plant Company

302 WEST JACKSON BOULEVARD ——— CHICAGO : ILLINOIS

EVERLASTING SEWERS

When a municipality constructs a sewer, it is expected to be a *permanent* improvement.

It is usually built at an enormous expense, deep in the ground, covered with an expensive pavement, and relied upon to serve its purpose regardless of storms, floods and other extra heavy demands upon it.

It is only natural that the municipality should insist upon the utmost care in its design and construction. It is a kind of work that no one can afford to take chances with.

Failure means the loss of thousands, and in some cases millions.

Obviously, no material should go into a sewer that has not *proven* its ability to stand up under all conditions.

The cement should be most carefully chosen because upon it depends very largely the life of the sewer.

The municipality, the engineer or the contractor who desires to be absolutely safe and sure—to eliminate all possible chance of failure in the cement—must use Utica Hydraulic.

This is the only cement with an unbroken successful record of seventy years' actual working service in sewers.

In Chicago, Utica Cement has been used exclusively in over one thousand miles of sewers, and over sixty thousand manholes and catch basins.

It is in the large water tunnels under the city and under the lake.

Some of this work was done sixty years ago and is still in first-class condition.

Take no chances on your sewers—use the old and tried Utica Cement.

UTICA HYDRAULIC CEMENT COMPANY

UTICA, ILLINOIS

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YOU WILL FIND THEM USEFUL

EXPANDED METAL AND CORRUGATED BAR CO.

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Of every description for operating

BACTERIAL SEWAGE FILTERS : : : : SEPTIC TANK SYSTEMS

Also siphonic apparatus of every description for operating Intermittent Flush Tanks for Flushing Street Sewers.

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SEWER PIPE, FLUE LINING

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STEVENS' SONS CO. MFRS. OF SEWER AND CULVERT PIPE

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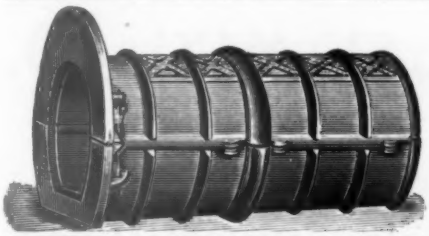
LOCOMOTIVE TILE, FIRE BRICK, ETC.

In two and a half feet lengths.
Deep Corrugated Sockets.

CORRESPONDENCE SOLICITED.



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Have more desirable features than any other. All regular sizes from 10 inches to 48 inches in sections 4 feet long, with or without bulkheads.

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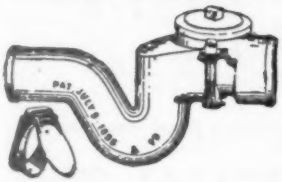

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Will Improve the Sanitary Condition of Any City or Town

Medical advisers recommend it in every home. A perpetual preventive against back water and sewer gas. Architects give it their highest approval.

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Wall Coping, Flue Lining, Chimney Tops and Fire Brick.

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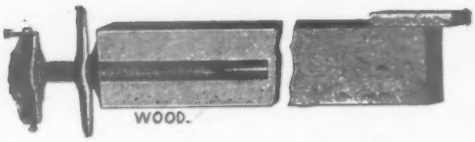

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Patented January 25, 1898.

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INDIANAPOLIS, IND.
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Standard and Double Strength

Sewer Pipe, Drain Tile, Culvert Pipe
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Konkurt Metal
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Cement Tools
For Every Purpose
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LARGEST STOCK
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SPECIAL WET CONCRETE SHOVEL

THE MIKOLA PATENT SHOVELS

are especially designed for use in handling concrete, crushed stone, iron ore, clay, etc. Save time, labor and money by using shovels made just for your line of work.

Write us about your needs and for Catalogue Dept. B.

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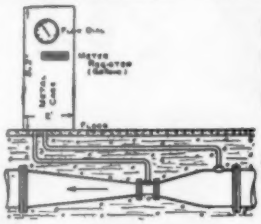

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Controlling Valves for Reservoirs and Standpipes.

Automatic Air Valves for Pipe Lines.

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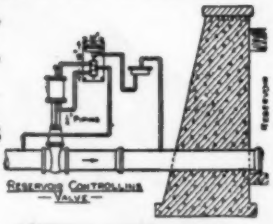
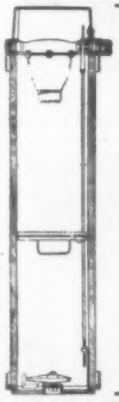


RESERVOIR CONTROLLING VALVE

SIMPLEX VALVE & METER COMPANY, 112 North Broad Street, Philadelphia, Pa.



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Among the many other points of excellence which the Ford Meter Box enjoys over all other makes is the fact that it is complete in itself. It requires not one cent of expense nor one minute's time to prepare it for its meter. It is adjustable to different makes of meters and is the most thorough protection from surface water, frost and all other damaging influences. It is light, durable and made by an experienced water works man to meet every requirement. Saves money and annoyance.

WRITE FOR DESCRIPTIVE BOOKLET

FORD METER BOX COMPANY

112 SOUTH HIGH STREET, HARTFORD CITY, IND.

BUILDERS IRON FOUNDRY, Providence, R. I., Sales Agents for New England

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INFRINGEMENT NOTICE

THE CLARK METER BOX has met with wonderful success. Is it any wonder that it is imitated? Our boxes are now in use throughout the entire country and they are giving perfect satisfaction everywhere. Thousands in use by THE UNITED STATES GOVERNMENT.

We wish to advise our many friends and patrons that our goods are well protected by patents and institution of legal proceedings have been commenced to protect our rights. All infringing MANUFACTURERS and USERS will be prosecuted to the fullest extent of the law.

Let us tell you about our IRON COLLAPSIBLE FORM for the manufacture of CONCRETE METER BOX Bodies, at one-fourth the cost of any other box body. Our TEKSAGON (No Gasket) Meter Coupling is a wonder. Costs no more than ordinary coupling.

Drop us a postal card for catalogue.

H. W. CLARK CO., 1512 Broadway, Mattoon, Ill.

BOXES FOR WATER METERS

We make a complete and finished meter box, including all pipes in place and meter connections, frostproof, air-tight, water-proof, for $3.00.

Durable—no expense to maintain—easily accessible for reading or removing the meter; protected from interference or injury.

WRITE US

THE GRAND RAPIDS METER BOX CO.

674 Wealthy Avenue **Grand Rapids, Mich.**

ACCURATE AND DURABLE

WATER METERS

with standard six-hand or straight reading dials, indicating in cubic feet, gallons or liters. Also meters for fuel oil, or other liquids.

BUFFALO METER CO.

290 Terrace, Buffalo, N. Y.

ESTABLISHED 1892.

Barrett's PAVING PITCH

Mommout Street, Newport, Ky., Showing Pitch-Filled Pavement

BETTER THAN SAND, CEMENT OR ASPHALT

Brick pavements must have some filling between the joints, else they will shift, creep and chafe. Various compounds are employed to fill the interstices, namely sand, cement, asphalt and pitch.

Sand is only a makeshift. It is cheap but it does not protect the foundation from water, which in the form of frost creates havoc below.

Cement at first sight seems ideal. It strengthens the whole pavement, making a monolith of it, and it is water-tight But it fails to provide for the expansion and contraction of the brick, hence the pavement bulges and breaks out in hot weather or contracts and cracks in cold weather. It bridges depressions in the foundation and then gives way under weight of traffic, leaving long, dangerous breaks. Special expansion joints breed special troubles of their own.

Asphalt demands (and rarely gets) ideal conditions of application and expert workmanship. Its adhesion to the brick is weak. When the brick contracts, brick and asphalt part company, leaving the asphalt in loose slabs that can be picked out with the fingers. It is a little better than sand.

Pitch of the right grade, viz: Barrett's Paving Pitch Filler is always absolutely water-tight, being soft enough at ordinary temperatures to keep all interstices tightly filled and to adhere tenaciously to the blocks. It is permanent and its cost is only about one-half that of any other material that even approaches it in efficiency.

Booklet on application.

Barrett Manufacturing Company

New York Chicago Philadelphia Boston Cleveland
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MAKES A

NOISELESS BRICK PAVEMENT

Sarco is an elastic, rubbery filler which prevents wear on the edges and corners of the brick. Increases the life, decreases maintenance cost.

Standard Asphalt and Rubber Co.

First National Bank Bldg., Chicago

NEW YORK CITY · PITTSBURG, PA. · KANSAS CITY, MO.

Applying "Tarvia B," Gouverneur, N. Y.

ROAD ECONOMY

While primarily Tarvia was intended for a dust preventative, it has proved to be a most wonderful road preservative as well, and in that way its use saves in maintenance expense much more than the cost of the Tarvia treatment.

Mr. Linn White of the South Park Board of Chicago, says:

"In 1905, South Park Avenue was reconstructed and paved with macadam twelve inches thick. The cost of construction was $1.25 per square yard. In 1906, it was repaired and rerolled at a cost of 2¾ cents per square yard. In 1907, about 6 cents per square yard was expended in maintenance, and it is now estimated that it will cost at least 20 cents per square yard to resurface and carry it through the season of 1908 in good shape as a plain macadam street. This is a maintenance cost of about 10 cents per square yard per year for the period of three years, exclusive of sprinkling and cleaning. This means the round of repairs and resurfacing would only be begun over again at a gradually increasing cost each year. In its present condition there are numerous depressions one to two inches deep and a sprinkling of loose stone may be seen over the surface loosened and thrown up by the automobiles.

"In 1906, two miles of Grand Boulevard were treated with Tarvia at a cost of 6 cents per square yard, plus a trifle for a little new stone used in redressing. In June, 1907, three blocks were spiked up and re-treated with Tarvia. The rest of it, thirteen blocks, remains in fair condition up to date with not more than five per cent. repaired in 1907. It may be expected to go through the season of 1908 with a very small percentage of repairs."

The entire surface of Grand Boulevard has since been treated at a cost of 2½ cents per square yard, making a total cost for the Tarvia treatment and three years' maintenance of less than 9 cents per square yard, which contrasts favorably with the 28¾ cents required on the South Park extension of the same street.

It should be borne in mind also in connection with this work that the cheaper tarviated road was dustless, whereas the South Park avenue extension with its high maintenance cost required continual sprinkling with water, and even then was a source of complaint to residents and pedestrians. *Booklets on request.*

BARRETT MANUFACTURING COMPANY

New York	Chicago	Philadelphia	Boston
Pittsburg	New Orleans	Minneapolis	Cincinnati
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TRADE B MARK

"HIGH GRADE NATURAL ASPHALTS"

FOR PAVING AND ROOFING PURPOSES

EXCEL THE ARTIFICIAL
UNAFFECTED BY WATER
AS SHOWN IN ACTUAL USE

Wears Longer Than Man-Made Asphalts and Coal Tar

THE A. L. BARBER ASPHALT COMPANY THE WEST STREET BLDG. 90 WEST ST., NEW YORK

MADE BY THE MILE!
SOLD BY THE FOOT!

SIASTEX
WATERPROOFING FABRIC

IT IS AN ASPHALTED TEXTILE

MANUFACTURED ONLY BY
THE SICILIAN ASPHALT PAVING CO.
41 PARK ROW, NEW YORK

GABRIEL & SCHALL
205 PEARL ST., NEW YORK
Sole Importers of the only
Genuine "Brunswick" Asphalt Mastic
Trade Mark, Reg. in U. S. Pat. Office

Our "Brunswick" is branded as here shown.

All Others are Imitations

BRUNSWICK G.&S. GERMANY

ALSO IMPORTER OF HIGHEST GRADE OF Soft BITUMEN

Well Known for 25 Years

AMERICAN ASPHALTUM & RUBBER COMPANY
CHICAGO, ILL.

Pipe Dip
Brick Filler
Paving Cement
Mastic
Waterproofing

SUCCESSFULLY USED OVER TEN YEARS

Uvalde Asphalt Company
1 Broadway ... NEW YORK

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MANUFACTURERS OF **HYDROLENE B**

FAIRFIELD REFINED ASPHALT
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FAIRFIELD ANTI-DUST ASPHALT

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No. 213 St. Paul St. Baltimore, Md.

Ask Us Questions

Every subscriber to Municipal Engineering is invited to use our question department. We give you the benefit of the most authoritative information obtainable.

GOOD PAVEMENTS
PROPERLY CONSTRUCTED
SAVE MONEY

Our printed matter contains important paving facts. Write for it today.

There is real economy in a good pavement properly laid. That is why it pays to have your work done by paving specialists. Our long practical experience in all kinds of paving work enables us to produce the best pavement possible out of the material you wish to use. We make a specialty of BITULITHIC but will gladly furnish bids on any material desired.

HOOSIER CONSTRUCTION COMPANY

332 American Central Life Bldg. INDIANAPOLIS, INDIANA

Capacity—40,000 tons per year. 99.6 per cent. bitumen.

GLOBE ASPHALT CO.

REFINERS OF

"OBISPO"

BRAND

CALIFORNIA ASPHALT

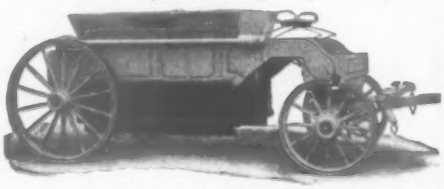
LIQUID AND SOLID

Samples and prices furnished to responsible parties not connected with the Asphalt trust.

Address all inquiries,
405 Blackwell Bldg., PITTSBURG, PA.

Hauling?

If so, do you keep careful "tab" on the size of loads hauled? There is a big difference not only in the capacity of wagon boxes but in the ability to stand up under heavy loads. Troy wagons have large boxes and an enormous factor of safety in strength. By actual test a Troy wagon has up held a load of 36 tons! We will send you full details of this test, which proves the claim that the Troy is the strongest wagon made. We will also send you our catalogue giving full details as to the construction of the Troy dump wagon.



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OR CANADA
PATENTS
$25.00

We pay all expenses and disbursements except government fees

Write to us for preliminary opinions on all legal matters. No charge unless retained.

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The INDUSTRIAL LAW LEAGUE (Inc.)

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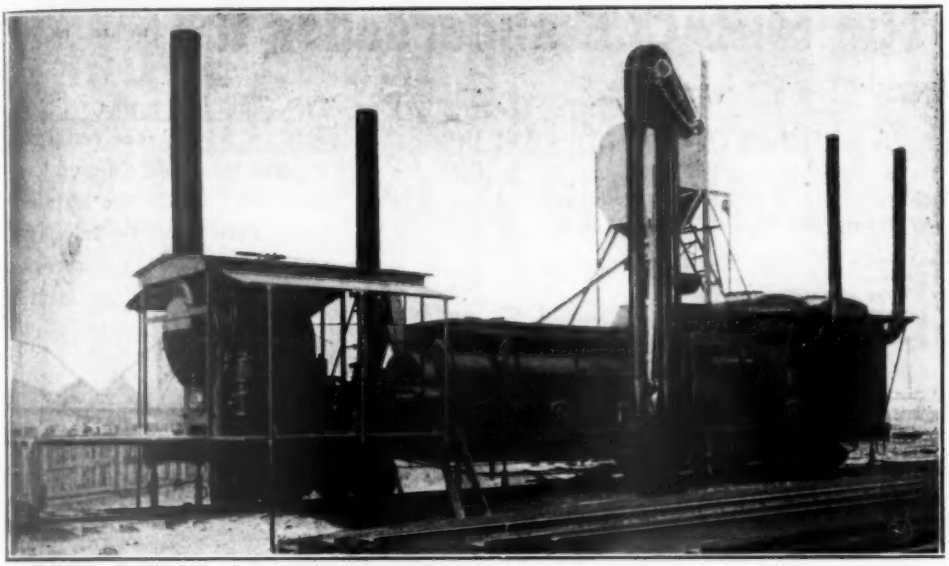

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The Only Profitable Portable Plant Proposition

Complete on One Car

Selling fast as we can turn them out. No failures.
Our customers duplicate their orders

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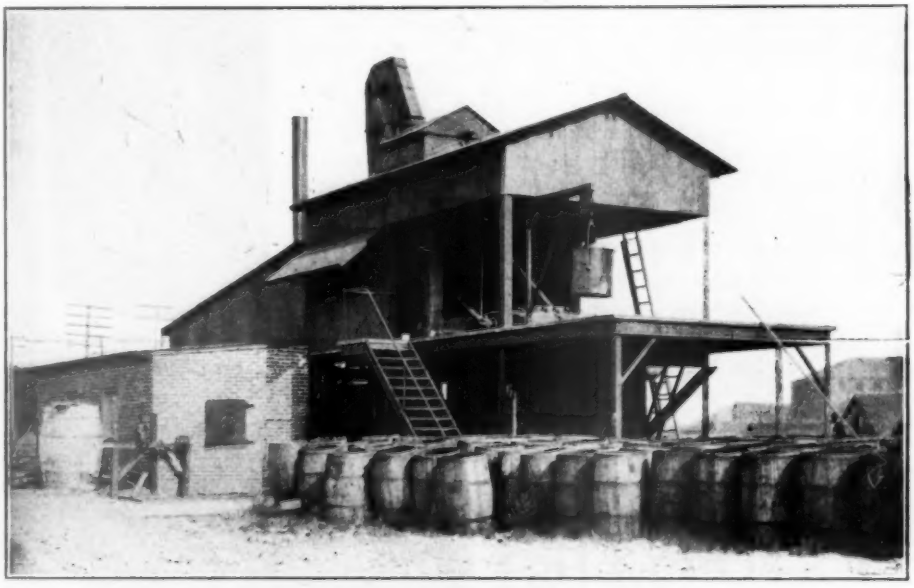
INDIANAPOLIS, IND., U. S. A.



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Here is a Little Wonder. Five Hundred Yards per Day Capacity for Patching

When you deal with us you get from **First Hands.** We own and operate our own steel works, foundry, pattern shop and machine shops. We have facilities and experience not to be found elsewhere

You Pay ONE PROFIT. Cheapest as well as BEST. All Kinds and Any Capacity

The MIRACLE supersedes the - - - -

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THE MONON CEMENT TILE COMPANY

MONON, IND. July 16 1908

Manufacturers of Cement—Drain Tile

Miracle Pressed Stone Co.
Minneapolis

Dear Sirs—

We wish you to ship us C.O.D. by express 1- 12 inch tile mold (2-ft length) quoted at $20.00 weight 70 lbs. We are using the machine & want to give yours a trial & if they prove satisfactory we may be able to do business with you. Kindly acknowledge receipt of this & oblige

Yours very truly
Monon Cement Tile Co.
By H. A. Bond

Sewer Pipe

"

Fence Posts

"

Telegraph Poles

"

Bricks

"

Blocks and Shingles

Discount?

This letter was written July 16, 1908; received July 18, and the mold shipped the same day. That the Miracle Mold need only be tried to win is shown by the following order received 3 days later:

Monon, Ind., July 21, 1908.

Miracle Pressed Stone Co.,
Minneapolis, Minn.

Dear Sirs:—We are in receipt of 10" straight Tile Mold and have given same a trial with satisfactory results. Kindly send us by express one 12" straight Tile Mold complete.

Yours very truly,
The Monon Cement Tile Co.

We want you to have our 24-page Pipe Mold Catalog. Sent free. It gives valuable information on the business in general, including experience of people who have made successes, gives reports of thorough tests of cement tile made by Iowa State College, compared with clay tile. Shows New Miracle culvert molds; Miracle man-hole mold; how to make Y's and T's from standard pipe without extra tools, and other things of practical value.

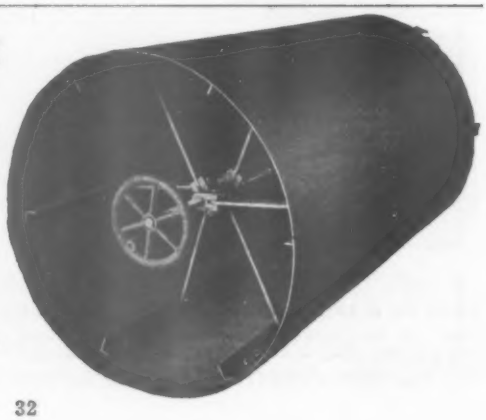
144-PAGE BOOK on Concrete, 600 Illustrations, sent for 24 cents in stamps. Money back if not satisfied.

MIRACLE PRESSED STONE CO.
119 Wilder St., MINNEAPOLIS, MINN.
Largest Manufacturers of Concrete Machinery in the World

Adjustable Steel Centers

FOR MAKING

CONCRETE SEWERS CULVERTS, ETC.



Write for Pamphlet

ADJUSTABLE STEEL CENTERING CO.
FOND DU LAC, WIS.

MORE ABOUT RUST

The best Chemist is "Father Time."

He is the final analysis, and if he tells you a thing lasts there is no need to soak it in sulphuric acid to find out.

Such experiments are interesting, but you don't buy culverts for that purpose.

You know what you want in a culvert —**strength, durability, ease** and **quickness** in **handling** and relative **low cost**—and it's my job to convince you that I have all these desirable points in my **short length cast iron pipe.**

I might (if I could sell enough culvert pipe to afford it) take you to the International Good Roads Congress that is being held in the city of Paris, France, this month, and show you cast iron pipe made in lengths of 1 meter (about 3′ 3½″), with flange joints, that **was made in 1664,** or **earlier,** and is **still in use** under pressure, supplying water to the great fountains in the park at Versailles, just outside the city.

This information comes from an eminent French Engineer, who states further that "The few repairs that have been required have generally been necessitated by the bad condition of the **bolts** which have **rusted out.**" (Emphasis is mine.)

The **bolts** are of wrought iron, many times heavier than rolled sheet metal, and yet they **rust out.**

Next issue I will tell you in a few simple words the "**reason**" cast iron **don't** rust.

In the meantime, think this matter over. Study this picture of a length of 12″ Pipe—it's **light, it lasts,** and the **strength** is there.

"The reason is in the ribs."

LET ME QUOTE YOU PRICES

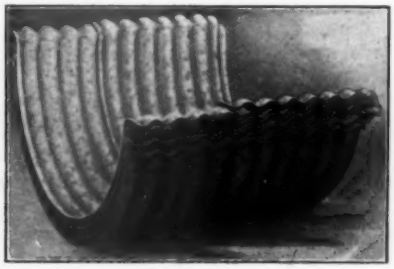
R. C. McWANE

220 Broadway, NEW YORK

"ACME"

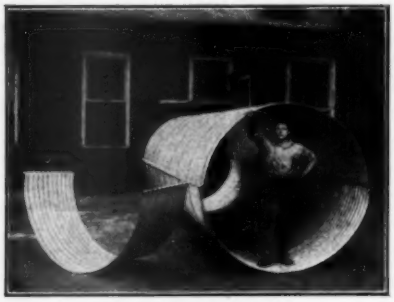
Corrugated Metal Culverts

(NESTABLE-PATENTED)



ARE SHIPPED THIS WAY

HAULED THIS WAY



SET UP THIS WAY

THE BEST CULVERT PROPOSITION GOING
IT'S WORTH WHILE INVESTIGATING
WRITE FOR BOOKLET "M2" AND PRICES

THE CANTON CULVERT CO.

SOLE MANUFACTURERS

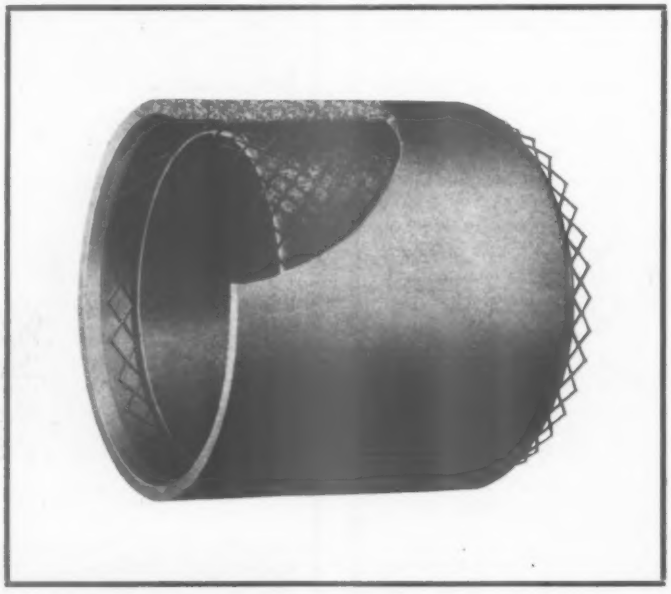
CANTON, OHIO, U. S. A.

MERIWETHER SYSTEM

CONTINUOUS CONCRETE PIPE

(REINFORCED)

SEWERS, CULVERTS CONDUITS



The only concrete pipe having continuous and uniform reinforcement throughout entire line of pipe when it is laid in the trench.

Joints locked and sealed from interior of pipe, giving continuous invert and absolutely tight joints.

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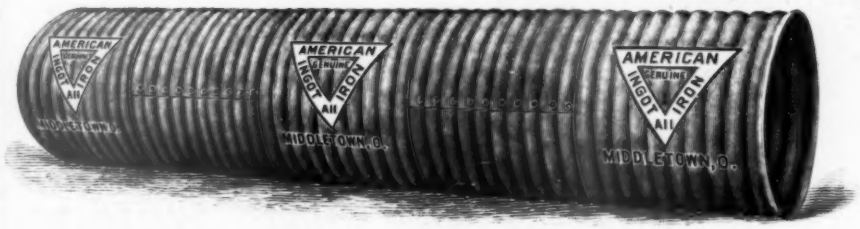

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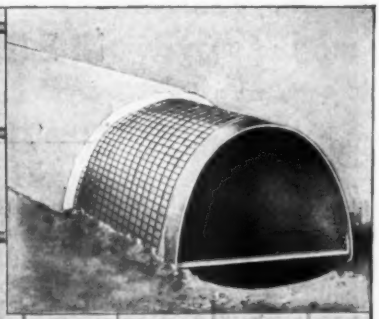

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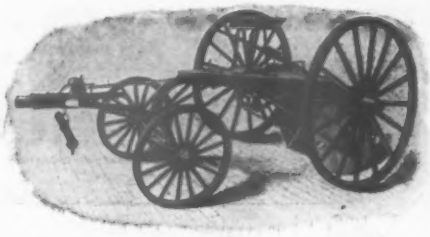

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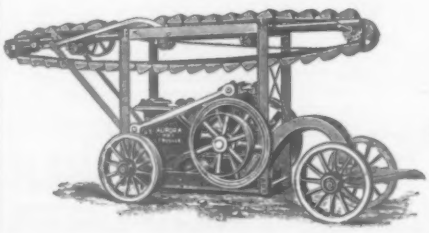

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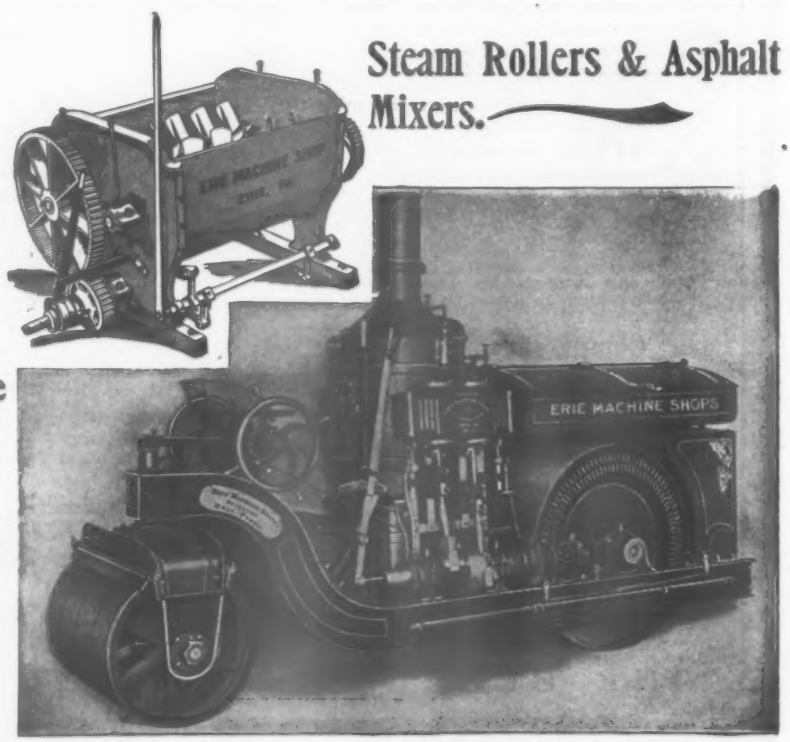

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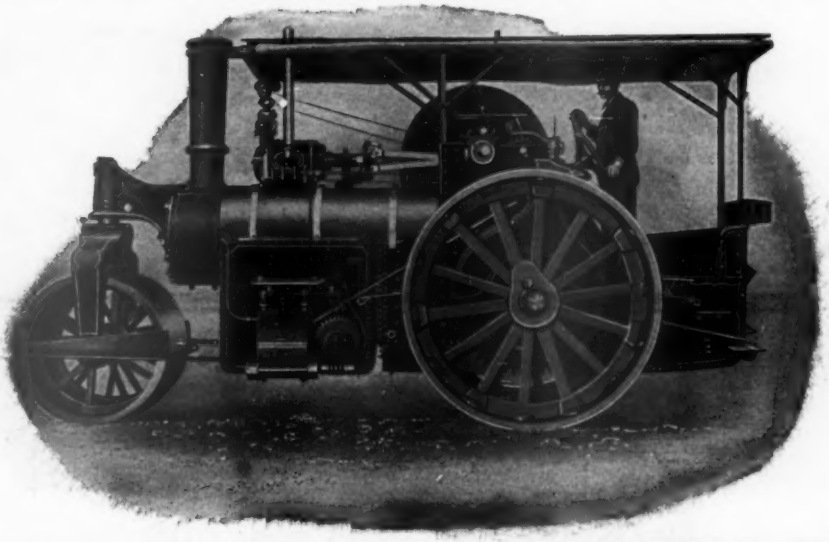

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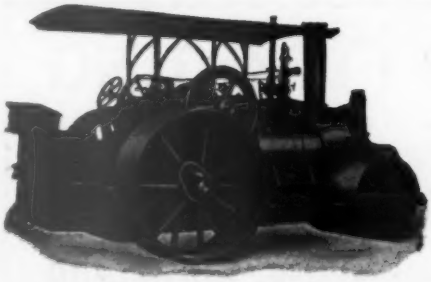

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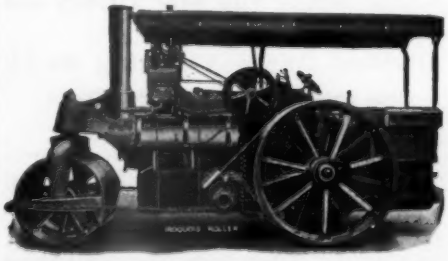

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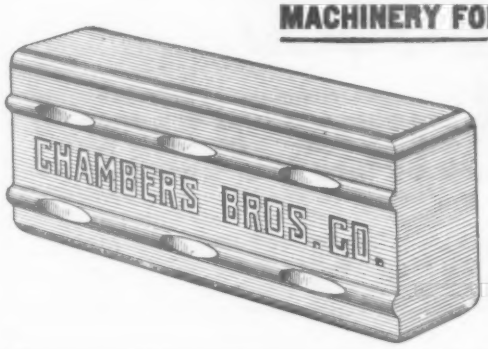

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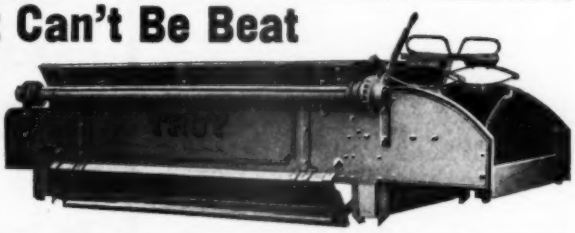

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Brick Dies, Moulds and Piano Wire Screens are positively

THE VERY BEST

and therefore are the most economical.

The

PORTSMOUTH MACHINE & CASTING CO.

LET US FIGURE WITH YOU PORTSMOUTH, OHIO

WHAT DO YOU WANT ?

Are you seeking Employment

Have you second-hand Machinery for Sale

Do you want Machinery or Supplies

Do you want men for Employment

A **"Want"** advertisement in MUNICIPAL ENGINEERING will be the most thorough, the least expensive and the surest way of finding the opportunity you seek. Rate 1½ cents per word each insertion; minimum charge, 50 cents.

FOR SALE—No. 1 Foote Concrete Mixer, steam; mixer and engine in good condition; used 90 days. Price, $500. City Construction Co., 505 W. Pratt, Indianapolis, Ind.

FOR SALE—Controlling interest in water works plant. Paying good dividend. Town twenty-five hundred population. Fine opportunity to operate electric lights and ice factory in connection. JNO. C. AMSLER, Hempstead, Texas.

POSITION WANTED—High-grade bridge engineer seeks new position. College graduate. Twenty years' experience. Will take entire charge of difficult work. Accustomed to design in either wood, steel or concrete. Special attention to economic design. Reply to Chief Engineer, 12133 Eggleston Ave., Chicago, Ill.

POSITION WANTED—By an experienced, married, affable man, executive ability, to assist contractor doing sewer, paving, sidewalk and curb and gutter work. Qualified to assume full charge of general or local offices, to round up work, assist on estimates, also assist superintending construction. I have an accurate working system of costs and record of account; clear record; A No. 1 references. Ready to give services at once. Address "SUBSCRIBER," care of Municipal Engineering Co., Indianapolis.

REINFORCED CONCRETE RESERVOIR.

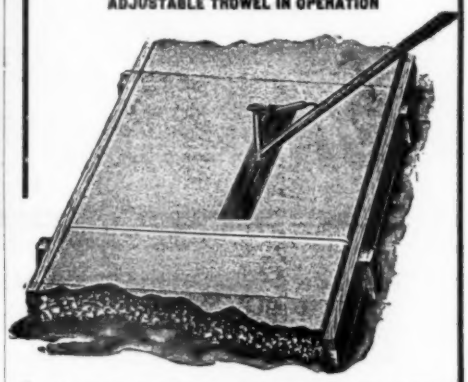
Sealed proposals will be received by the Board of Trustees of the Town of Newcastle, Indiana, at 8 o'clock p. m., Tuesday, October 6th, 1908, for the construction of a reinforced concrete reservoir at the water and light plant in said town. Specifications and plans on file in the office of the Town Engineer. Copies will be mailed to contractors upon application. Each proposal must be accompanied by certified check for $200, payable to town of Newcastle, Ind.

J. S. McQUINN, President Board.
G. E. MAHIN, Clerk.

"I AM FOR SIDEWALK MEN"

Lack of experience will not interfere with you finishing a walk in first-class shape if you use me

ADJUSTABLE TROWEL IN OPERATION

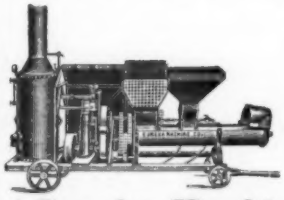


Send for Catalogue of Connelly's Adjustable Cement Finishing Tools

showing cuts of five other practical tools that fit the adjustable handle, namely: Edger, jointer, pointing trowel, and a combination curbstone finisher. We make special mention of the curbstone finisher, as it is the only one of its kind that in one operation completely finishes the curb, cuts the curb joint and turns the edge, thereby doing away with all previous operations. Address all communications to

P. F. CONNELLY :: El Reno, Oklahoma

MIXERS



Ask for New Catalogue

Eureka Machine Co.

995 May St. LANSING, MICH.

Philadelphia **LINK-BELT COMPANY** Indianapolis

New York St. Louis Chicago Seattle Pittsburgh

CONVEYING & POWER-TRANSMITTING MACHINERY

"From Canada to the Gulf From the Atlantic to The Pacific"

AN advertisement in *Municipal Engineering Magazine* does business everywhere. It offers the most thorough and effective advertising service that can be secured in this field. A great many of its advertisers do no other advertising because they are satisfied that *Municipal Engineering* does all for them that can be done. The accompanying letter proves its efficiency. It is the only publication used by this advertiser, and, as the letter indicates, it does its work thoroughly and well.

LIMA, OHIO, Sept. 25, 1908.

Municipal Engineering Co.,
Indianapolis, Ind.

Gentlemen—

As an item of news we beg to advise that we have just delivered one of our large One Car Asphalt Plants, that we have been advertising in your Journal, to H. P. Streicher & Company of Toledo, Ohio; and have just closed a contract for delivery within fifteen days for another one for The Texas Company of New York City, the same to be delivered in Texas.

We have had a good run on these plants this year. Our outlook for the coming year is first class.

We attribute our success with this plant, *First*, to the merit of same; *Second*, to the thorough advertising it has received through your valuable Journal as we are advertising with no one but you, and our inquiries have extended from Canada to the Gulf and from the Atlantic to the Pacific. Very truly yours,

THE EAST IRON & MACHINE CO.,
Per J. L. SIMPSON, *Secretary*.

If you are seeking business in this field, you can find no better helper than an advertisement in Municipal Engineering.

BITU-MINERAL
PAVING CEMENT

Is the only paving cement on the market that will produce bituminous streets that are unaffected by water and weather conditions.

BITU-MINERAL CEMENT

Shows its superiority in the "how" and the "where" of the making. That is, every gallon of Bitu-Mineral Cement is manufactured with the greatest care by the most modern and scientific method.

BITU-MINERAL CEMENT

Enables contractors in all parts of the country to build the most durable bituminous streets at proper, not unreasonable prices. Contractors and municipal authorities should write and learn of the unhampered opportunities they now have to build Bitu-Mineral and other approved forms of bituminous macadam pavements at a minimum first cost.

NATIONAL BITUMEN COMPANY

INDIANAPOLIS, INDIANA

Saves Labor
Saves Expense

For water-works companies the American Standard Water-Works Bookkeeping System saves labor, which is a large item, and insures economy, which is important. If your bookkeeping isn't right everything is apt to go wrong.

If you want to start right send your order for the books now.

WHAT IT IS

It is a comprehensive system of bookkeeping, founded upon the latest and best accountant methods as applied to the needs of Water Companies.

WHAT IT DOES

It saves time and labor, eliminates unnecessary entries, reduces liability to mistakes, and simplifies the whole method of the keeping of records. ALL THIS SAVES MANY TIMES THE COST OF THE BOOKS.

HOW IT WAS DEVELOPED

The American Water-Works Standard Bookkeeping System is based upon a careful study of methods in use by Water-Works Companies throughout the country, and embraces the good features of them all. It is the outgrowth of a competition instituted by MUNICIPAL ENGINEERING MAGAZINE, in which prizes were offered for the best set of forms. In response to this call many blanks were received from points throughout the United States and Canada, and after a careful examination of them by a committee, the prizes were awarded.

NO ONE SET, however, was found to embrace all the good points of others and many of the better ones were cumbersome in the extreme. These forms were afterwards taken in hand by competent accountants and carefully studied, and, after a thorough sifting and pruning, the best features of them all were embodied in The American Water-Works Standard Bookkeeping System.

IT COMPRISES

(1) A Rated Water Register for flat-rate consumers; (2) Metered Water Register; (3) Special Register; (4) Delinquent Register; (5) Cash Received Book; (6) Cash Disbursement and Voucher Record; (7) General Ledger; (8) Journal; (9) Card Index System. Books can be ordered separately.

THE SYSTEM IS COPYRIGHTED

and Books Made Under Patent

We will protect, in every lawful way, and promptly prosecute any infringements of our rights.

It is the best Bookkeeping System for Water Companies ever devised and the books are the cheapest.

A large number of Water Companies under both public and private ownership in every state in the Union are now using this system.

It has so many real advantages that it is worth your while to investigate.

Write for booklet giving full description.

MUNICIPAL ENGINEERING COMPANY

Commercial Club Building **Indianapolis, Indiana**

THE GAMEWELL FIRE ALARM TELEGRAPH COMPANY

MANUFACTURERS AND CONTRACTORS FOR OVER 50 YEARS OF

Fire Alarm and Police Signal Telegraphs

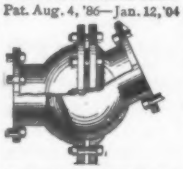
AND FOR SPECIAL APPARATUS THEREFOR.

OVER 1,300 Plants in actual service in the United States and Canada. Plants also established in Cuba, Philippine Islands, South America, Germany, Hawaii, West Indies, England, Norway and South Africa.

JOSEPH W. STOVER, President C. W. CORNELL, Secretary W. W. BOWES, Treasurer
WILLIAM GELLATLY, Gen. Supt.

EXECUTIVE OFFICE 19 BARCLAY STREET, NEW YORK CITY

HOLMES FLEXIBLE JOINT
Pat. Aug. 4, '86—Jan. 12, '04



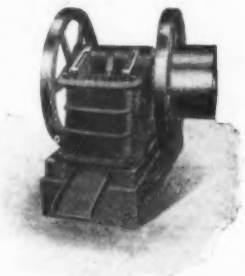
FLANGED JOINT for WATER PIPE

A. L. HOLMES

GRAND RAPIDS, MICH.

Manufacturer of

Flexible and Expansion Joints for Water Pipes, Gas Pipes, Oil Pipes, Air Pipes, and any purpose where a Flexible or Expansion Joint is desired. Made in sizes for Pipes from ½ to 48 inches in diameter and any pressure. Have been used for 25 years. Flanged, hub or screwed ends. The strongest, easiest to use, low first cost, the best.



BUCHANAN
ROCK BREAKERS

Portable and Stationary Plants Complete

Sizes 8" x 14" up to 30" x 60"

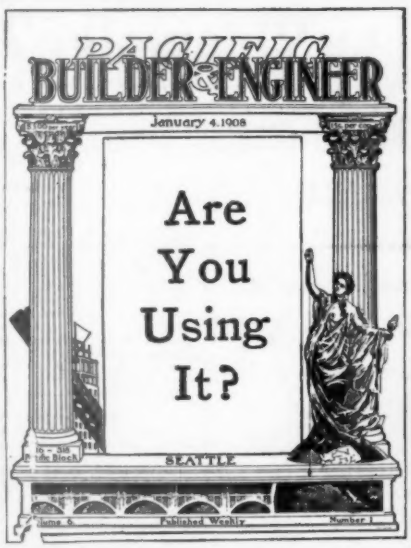
Capacities from 50 to 3000 Tons per day

STYLE "C" CRUSHING ROLLS—18" x 12" TO 60" x 60"

SEND FOR CATALOGUE NO. 5

GEO. V. CRESSON CO.

Philadelphia, Pa. **90 West St., New York, N. Y.**



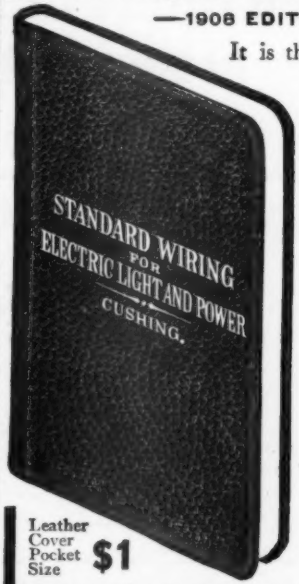
If not, you are losing the best chance of your life of getting before the buyers of a section where business is rapidly reviving; buildings and new plants are being put up, and old equipments being overhauled and renewed.

44 pages every week of fresh Advance Information. $5.00 per year. Send for Sample Copy—FREE.

317 A, Pacific Block : SEATTLE, U. S. A.

"The Recognized Authority on Wiring and Construction"

—1908 EDITION—



It is the only book on electric light and power wiring kept strictly up to date. It contains every rule, table and formula for every class of wiring. It settles disputes, and, if referred to before wiring, prevents disputes.

Leather Cover Pocket Size **$1**

Municipal Engineering Co.

Indianapolis, Ind.

WAINWRIGHT GALVANIZED STEEL CORNER BAR

For Protecting Edges of Concrete Curbs, Steps, Columns, Etc.

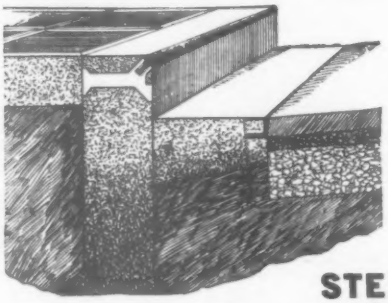
The only effective **CONCRETE EDGE PROTECTOR** offered to the contracting public

WAINWRIGHT PATENTS—March 9, 1897. November 22, 1898. May 5, 1903. March 26, 1907. August 29, 1907.

This bar is well galvanized so it will not rust. Has a **solid head,** guaranteeing resistance from the heaviest possible impact of wheels or other heavy bodies, and is held in place by a **dove-tailed web** forming an anchorage extending its full length, not only anchoring but supporting the **solid head** every inch of its length.

This bar has been in public use for more than ten years as the main feature of the

WAINWRIGHT STEEL-BOUND CONCRETE CURB



THE BEST IN THE WORLD

OVER ONE MILLION FEET

In use in more than one hundred and fifty cities in the United States.

The **dove-tailed web** anchors the bar at all points, resulting in great superiority over a corner protector anchored by bolts, wires or rods at intervals, allowing buckling or expansion, causing ultimate loosening of the metal from the concrete.

METAL PARTS FOR SALE

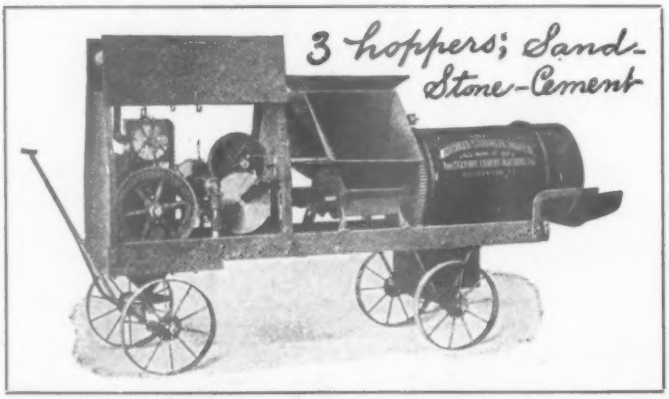
Correspondence invited.

STEEL PROTECTED CONCRETE CO.
Real Estate Trust Building, PHILADELPHIA, PA.

Do You Make and Lay Sidewalks?

Then You Need a HERCULES Concrete Mixer

It will save you *money*, *time* and *labor*, besides giving you *better concrete*. It's just what you've been looking for—a first-class machine that can *really* be depended on for properly *proportioning* and *mixing* concrete—all that is necessary is to keep the hoppers filled.



The Hercules Mixer proportions the materials *accurately*, then mixes them thoroughly. Proportions can be changed instantly without the use of *sprockets, chains* or *belts*. The proportioning feed once set for a given proportion cannot possibly get out of adjustment. Proportions cannot vary because it's a *forced* feed and *not a worm feed*—that's what makes it reliable.

You can regulate the capacity to meet the requirements of the number of men employed. The hoppers are low, allowing you to shovel direct from the ground without the aid of a platform. Either hopper can be used for coarse or fine material as desired.

There are no movable paddles to wear and break and partially mix, because it's a continuous drum mixer, and while continuous can be used as a *proportioning batch mixer* by merely shutting off the feed and allowing the drum to run. The entire machine is always in perfect control of the operator and can be started and stopped instantly. This machine is a long step in advance of anything that has hitherto been made in the mixer line. Send for catalogue and full information to-day.

CENTURY CEMENT MACHINE CO. Makers of the Famous HERCULES Concrete Block Machine
181 W. Main Street, ROCHESTER, New York

THE BEST IS THE CHEAPEST

PENINSULAR PORTLAND CEMENT JACKSON, MICH.

TRADE MARK.

PENINSULAR PORTLAND CEMENT CO

GENERAL OFFICE, JACKSON, MICH.

COWHAM SYSTEM

Bedford

Portland Cement

The Brand that Fills All Requirements

RELIABLE

Every Barrel Guaranteed.

Write, Wire or Telephone

United States Cement Co., Bedford, Ind.

OMEGA

Exact Composition.
Correct Chemical Analysis.
Burned in Rotary Kilns.
Ground in Ball and Tube Mills.

THE OMEGA PORTLAND CEMENT CO.,

ITS PRODUCT IS SEASONED

Before shipping and guaranteed to withstand satisfactory neat and sand tensile strains—cold and hot water tests; chemical and sieve tests. We grind 98 per cent. fine on sieve of 20,000 meshes.

Jonesville, Michigan.

KRUPP

GRINDING MACHINERY
STEEL TIRES & WHEELS
SHAFTS & FORGINGS

THOS. PROSSER & SON, 15 GOLD ST., NEW YORK; OLD COLONY BLDG., CHICAGO

THE HAND-BOOK for CEMENT USERS

THIRD EDITION

Is the most practical work on the use of cement yet published. Contains no burdensome theory, but gives facts, demonstrations and examples of work that has been actually performed and proved practical and satisfactory. Informs you how to select the best cement, write specifications for cement, write specifications for the work in which the cement is to go, put the work together, estimate the cost of materials and estimate the quantity of material.

Remember it is a practical work for practical men.

375 Pages, Cloth Bound, Price $3.00

Municipal Engineering Co., 28 S. Meridian St., Indianapolis

BLANC STAINLESS CEMENT

A true Portland Cement, WHITE in color

Meacham & Wright Company

Distributors for Illinois **CHICAGO**

Nazareth Portland Cement

One Mill-One Brand-One Quality-The Best

Uniform in color, strength and fineness

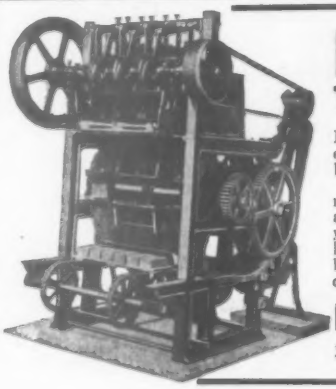
Every barrel and bag guaranteed both as to quality and weight

NAZARETH CEMENT CO. CHARLES WARNER COMPANY SALES AGENT NAZARETH PORTLAND CEMENT OFFICES WORKS NAZARETH, PENNA.

Charles Warner Company

General Sales Agt.—Main Office, Wilmington, Del.

Land Title Bldg., Philadelphia **1 Madison Ave., New York**



REAL BUSINESS—REAL PROFIT

The Hohn Power Tamp BRICK MACHINE

Is not an experiment. It is in successful operation and turns out concrete brick *tamped*, at the rate of **Twenty Thousand** perfect brick per day of ten hours.

The only hand work required is in putting the material in the mixer and removing the finished brick. This machine is strong and well made and will do what we claim for it or we don't want your money. Any man who understands concrete and can lay his hands on some good sand, can build up a large and profitable business with this machine. We furnish the machine alone or complete plant with all equipment. *Write today for our circular.*

HOHN CEMENT BRICK MACHINE COMPANY

327 Board of Trade :: **INDIANAPOLIS, IND.**

REINFORCED CONCRETE BRIDGE ON THE BIG FOUR RAILWAY AT AVON (NEAR INDIANAPOLIS), IND. UNIVERSAL PORTLAND CEMENT USED EXCLUSIVELY—8,000 BARRELS.

A Standard Portland for Universal Use.

Daily Output 17000 Barrels. Plants at Chicago & Pittsburg.

MUNICIPAL OFFICIALS can do no better than to require the use of Universal Portland Cement in the concrete work with which they are concerned.

The leaders in the building profession insure themselves against weak concrete due to poor cement and against the costly delays resulting from inadequate shipping facilities, by using Universal Portland Cement. Insist on Universal.

UNIVERSAL PORTLAND CEMENT CO.

Chicago Pittsburg

SUNFLOWER BRAND

PORTLAND CEMENT

Always a favorite with the trade. Never a barrel rejected.
Capacity 8,500 barrels per day.

UNITED KANSAS PORTLAND CEMENT COMPANY

811 COMMERCE BLDG., KANSAS CITY, MO.

ALPHA PORTLAND

On the market for the past sixteen years. One brand only manufactured —a strictly straight Portland—which in uniformity and general excellence can not be equalled.

THE RECOGNIZED STANDARD AMERICAN BRAND

ALPHA PORTLAND CEMENT CO.

GENERAL OFFICE
EASTON, PA.

LEHIGH PORTLAND CEMENT

GUARANTEED FOR UNIFORMITY, STRENGTH AND DURABILITY

RECOMMENDED FOR HIGH-CLASS ENGINEERING WORK

MANUFACTURED BY

LEHIGH PORTLAND CEMENT CO.

ALLENTOWN, PENNSYLVANIA

Western Office, 725 ROCKEFELLER BUILDING, CLEVELAND, OHIO

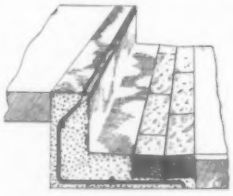
WRITE FOR PRICES. CATALOGUES, TESTS, ETC., MAILED ON APPLICATION

STEEL EDGE PROTECTED and REINFORCED

CONCRETE CURB

And Combined Curb and Gutter

Patented Feb. 20, 1906, Dec. 31, 1907. Pats. Pend.



Vertical and Horizontal Reinforcement.
Non-breakable and Always in Perfect Alignment.
Cheaper and More Durable than Granite.
Unequaled for Curved Corners.
Only Reinforced Curb Throughout.

SEND FOR CIRCULAR GIVING DESCRIPTION IN DETAIL

Concrete Edge Protector Co., 22 McGraw Bldg., Detroit, Mich.

KOSMOS CEMENT

Is a Portland of the Very Highest Grade

Kosmos Portland Cement Company (Inc.)

General Offices: 614-616 Paul Jones Building, Louisville, Ky

New Automatic Cement Tester

Gold Medal
St. Louis Exposition, 1904

Tinius Olsen & Company

500 North 12th Street
Philadelphia, Pa.

Manufacturers Cement and Concrete Testing Machines and all Auxiliary Laboratory Apparatus

From "Reinforced Concrete in Factory Construction."

When You Build Use Concrete

It is economical, durable, fireproof and sanitary; needs no paint or repairs, is warmer in winter, cooler in summer than any other construction and is adaptable to any type of

Factory, Warehouse or Mill

We have prepared for *Manufacturer and Merchant* a new book dealing solely with the important question of factory building—

"Reinforced Concrete in Factory Construction"

a book containing besides several general chapters on concrete, concrete aggregates, methods and materials for reinforcing—*ten chapters giving detailed descriptions of ten Concrete Factories and Warehouses* erected in various parts of the country by different systems. The photographs, sectional drawings and specifications for this book were furnished by the engineers in charge of the work.

This book, profusely illustrated (250 pages, size 6½x9), pamphlet bound, sent free upon request to Architects, Engineers and Manufacturers, who contemplate building.

Cloth bound copies 50 cents each.

The Atlas Portland Cement Co.

Dept. N **30 Broad Street, New York**

"Second to None"

NORTHAMPTON
PORTLAND CEMENT

ONE GRADE ONE BRAND

A True Portland Cement, Uniform in Strength and Color.
It is especially indicated for the highest class of concrete construction.
In the largest group of concrete buildings in the world, The Foster-Armstrong Piano factories, at Dispatch, N. Y., Northampton Portland Cement was used exclusively.

SALES OFFICE and WORKS: STOCKERTOWN, PA.

Not A Brick Displaced!—Not A Mark Of Erosion!

This was the finding upon recent examination of the big tube of the Niagara Falls Power Company, when the great torrent was unharnessed after nearly twenty years of unceasing flow through its mile and a half of winding tunnel.

These bricks were laid in

GIANT PORTLAND CEMENT

Manufactured by

THE AMERICAN CEMENT CO. - PHILADELPHIA

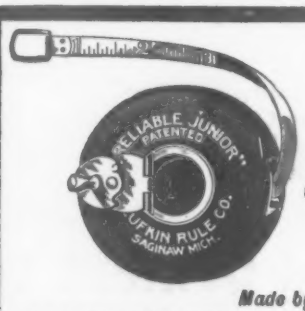
HIGHEST QUALITY ABSOLUTELY GUARANTEED

Uniformity
Fineness
Durability
Strength

WESTERN STATES PORTLAND CEMENT

Most perfectly equipped Cement plant in the world

WESTERN STATES PORTLAND CEMENT COMPANY : INDEPENDENCE, KANSAS



LUFKIN

TAPES AND RULES

ARE THE BEST IN THE WORLD.

Made by **THE LUFKIN RULE CO.**

FOR SALE EVERYWHERE.
SEND FOR CATALOG 188.

Saginaw, Mich., U.S.A.
New York. London.

IMPORTANT
To CEMENT BUYERS

Our output for 1908 will be about

4,000 Barrels Per Day

It will pay YOU to get our prices before YOU BUY

Wyandotte Portland Cement Co.
WYANDOTTE, MICHIGAN

ASK YOUR DEALER FOR

C. H. WOOD. AGT.
902 CHAMBER OF COM. BDG
CHICAGO, ILL.

HALF OF THE PORTLAND CEMENT PLANTS
IN THE UNITED STATES AND CANADA

USE SMIDTH MACHINERY

KOMINUTERS FOR GRANULATING **TUBEMILLS** FOR PULVERIZING

F. L. SMITH & COMPANY, 41 Cortlandt St., NEW YORK

IF YOU WANT THE

BEST SYSTEM OF BOOKKEEPING FOR WATER COMPANIES

WRITE TO

MUNICIPAL ENGINEERING COMPANY

TO USE IT SAVES AND PAYS

For Reinforced and General Concrete Work

STRONG : UNIFORM : DURABLE

Send for 72-page Illustrated Catalog No. 19

MARQUETTE CEMENT MANUFACTURING COMPANY, MARQUETTE BUILDING, CHICAGO

CHICAGO PORTLAND CEMENT CO.

MANUFACTURERS OF

"CHICAGO AA" PORTLAND CEMENT

WE MAKE ONE BRAND ONLY. THE BEST THAT CAN BE MADE.

53,330 barrels used in Thebes Bridge. 6,500 barrels used in Kankakee Reinforced Concrete Bridge. 1,050 barrels used in Kenosha Reinforced Concrete Bridge. Hennepin Canal, Government Post Offices, Principal Railroads and Contractors in the North-west, our patrons.

DEXTER Portland Cement

The Highest Standard Attainable

Sole Agents

Estab. 1844 SAMUEL H. FRENCH & Co., Philadelphia

Established 1866.

RUDOLPH S. BLOME CO.

PIONEERS IN

CEMENT PAVING AND CONCRETE CONSTRUCTION

BANK FLOOR, UNITY BLDG.

CHICAGO.

LARGER CONTRACTS EXECUTED IN ANY PART OF THE U. S.

Medusa Waterproof Compound

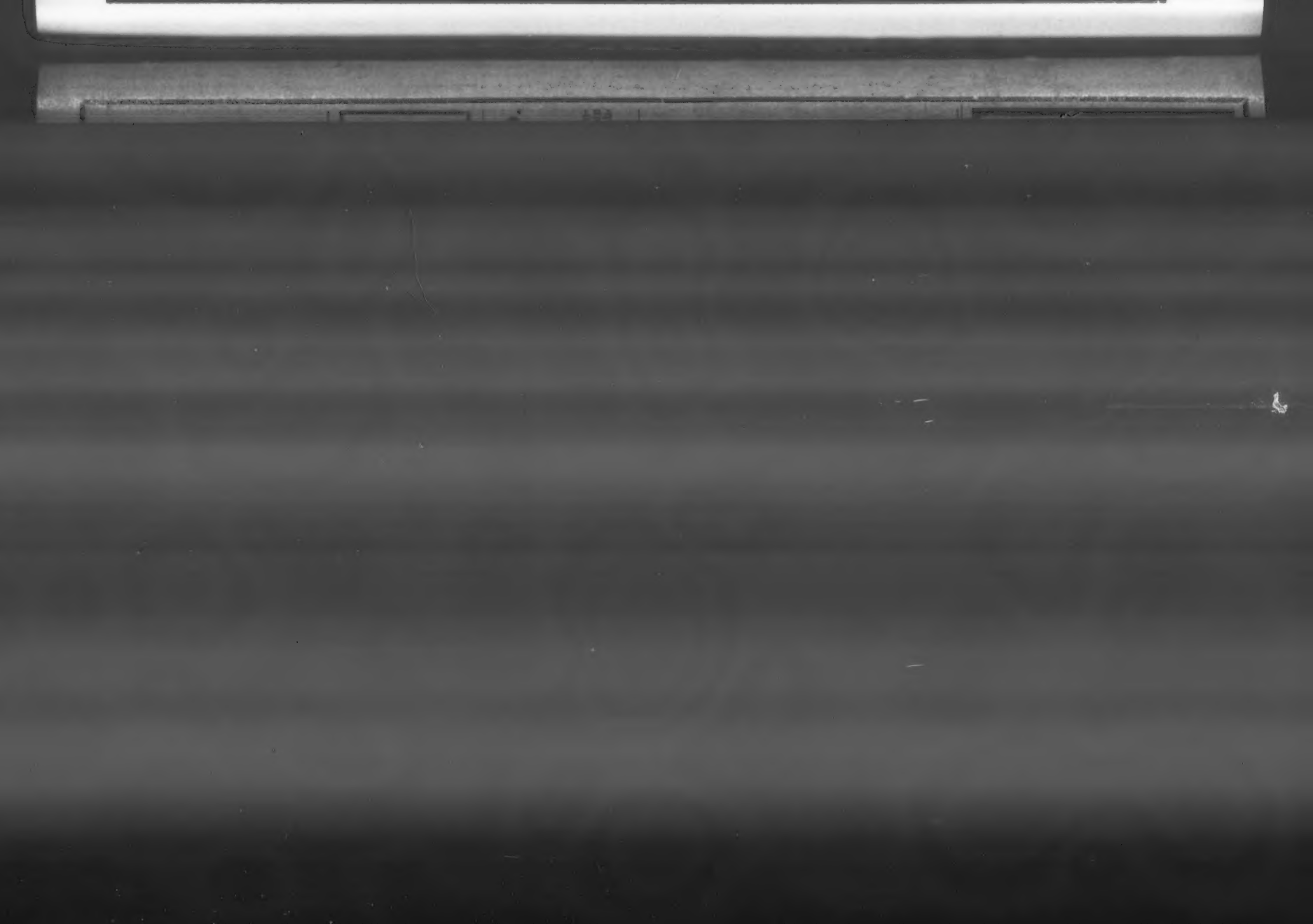
IS NOT A WASH OR AN EXPERIMENT

MAKES CONCRETE IMPERVIOUS TO WATER

Write for pamphlet describing its various uses, cost, tests, and illustrating some of the largest jobs in this country in which it was used. Beware of imitations and adulterated compounds that are sold for less than it costs us to make Medusa.

Write for Free Sample of our Pure White Portland Cement.

SANDUSKY PORTLAND CEMENT COMPANY : Sandusky, Ohio



THE SEAL *of* OFFICIAL APPROVAL

Has been placed on the Bitulithic pavement by the Mayors, Engineers and Street Commissioners of upwards of 200 cities in which it has been in use for the past two to seven years.

Time's remorseless test has proved every claim made for it eight years ago by its inventors, and today it stands preeminently the ideal street pavement.

"The widespread success of Bitulithic has induced imitation and consequent litigation, which are evidences, if such were needed, of the merits of the construction"—William Pierson Judson in his latest work, (1908) "Road Preservation and Dust Prevention."

Bitulithic literature should be in the hands of every city official. It's free for the asking. *Send for it now.*

Warren Brothers Company

BOSTON, MASSACHUSETTS

REGISTERED TRADE-MARKS

"Bitulithic" "Puritan" "Bitustone" "Bituminous Macadam" "Bitrock"

ASPHALT PAVING CONTRACTORS!

Which Do You Want?

A Permanent Investment or an Annual Expense?

The asphalt paving contractor today has a wide range from which to select his equipment. On the wisdom of his choice depends his success. It lies with himself whether his plant means a permanent investment with annual profits or an annual expense with nothing in return but vexatious delays and unsatisfactory work.

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Standard Asphalt & Rubber Co., Chicago, Ill.
The Texas Co., New York City.
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Warren Asphalt Cement Co., Cambridge, Mass.

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Contractors' Tool Co., Philadelphia, Pa.
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Century Cement Machine Co., Rochester, N. Y.
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Hoosier Construction Co., Indianapolis, Ind.
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J. E. Salfisberg & Co., Aurora, Ill
Sanitary Sewer Construction Co., Jackson, Mich.
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H. P. Streicher & Co., Toledo, O.
M. Tschirgi & Sons, Dubuque, Ia.

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The Conneaut Shovel Co., Conneaut, O.
Contractors' Tool Company, Philadelphia, Pa.
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D. S. Watson, Canastota, N. Y.

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Carson Trench Machine Co., Boston, Mass.
The Jeffrey Mfg. Co., Columbus, O.
Link Belt Engineering Co., Philadelphia, Pa.

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F. J. Lewis Mfg. Co., Moline, Ill.
Republic Chemical & Creosoting Co., Indianapolis, Ind.
U. S. Wood Preserving Co., New York City.

Creosoted Wood Block.
Kettle River Quarries Co., Minneapolis, Minn.
Republic Chemical and Creosoting Co., Indianapolis, Ind.
U. S. Wood Preserving Co., New York City.

Crushers, Rock and Ore.
Austin & Western Co., Ltd., Chicago, Ill.
Geo. V. Cresson Co., Philadelphia, Pa.
Jeffrey Mfg. Co., Columbus, O.

Crushed Stone.
Cleveland Stone Co., Chicago, Ill.
Ohio Quarries Co., Cleveland, O.
St. Louis Crushed Quarts Co., St. Louis, Mo.

Culvert Pipe.
American Rolling Mill Co., Middletown, O.
Canton Culvert Co., Canton, O.
Lock Joint Pipe Co., New York City.
R. C. McWane, New York City.
Trussed Concrete Steel Co., Detroit, Mich.

Culvert Pipe, Cast Iron.
Feltz & East, Lima, O.
R. C. McWane, New York City.

Culvert Pipe, Vitrified.
W. E. Dee Clay Mfg. Co., Chicago, Ill.
Buckeye Fire Clay Co., Uhrichville, O.
East Ohio Sewer Pipe Co., Irondale, O.
Michigan Sewer Pipe Co., Jackson, Mich.
H. Stevens' Sons Co., Macon, Ga.
Terre Haute Brick & Pipe Co., Terre Haute, Ind.

Culverts.
American Rolling Mill Co., Middletown, O.
Canton Culvert Co., Canton, O.
Feltz & East Co., Lima, O.
R. C. McWane, New York City.

Curbing.
R. S. Blome Co., Chicago, Ill.
Cleveland Stone Company, Cleveland, O.
Ft. Scott Stone & Constr. Co., Ft. Scott, Kan.
Ohio Quarries Co., Cleveland, O.
Steel Protected Concrete Co., Philadelphia, Pa.
Warren Bros. Co., Boston, Mass.

Dies.
Portsmouth Machine & Casting Co., Portsmouth, O.

Ditchers.
The Browning Engineering Co., Cleveland, O.

Drain Tile.
Boone Brick, Tile & Paving Co., Boone, Ia.
W. E. Dee Clay Mfg. Co., Chicago, Ill.
Michigan Paving Brick Co., Saginaw, Mich.
Michigan Sewer Pipe Co., Jackson, Mich.

Dryers.
Atlas Dryer Co., Cleveland, O.
F. D. Cummer & Son Co., Cleveland, O.
Iroquois Iron Works, Buffalo, N. Y.
Ruggles-Coles Engineering Co., New York City.

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Black Mfg. Co., Chicago, Ill.
Studebaker Bros. Mfg. Co., South Bend, Ind.
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Watson Wagon Co., Canastota, N. Y.

Duplex Brick Clamp.
Duplex Foundry and Mfg. Co., Cleveland, O.

Dust Layers.
Barrett Mfg. Co., New York City.

Dust Laying Compound.
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Impervious Product Co., Baltimore, Md.
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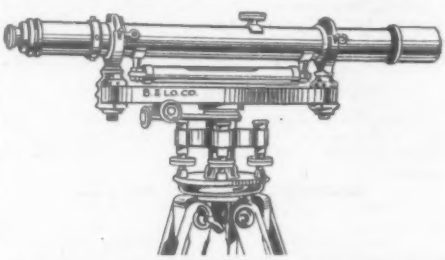

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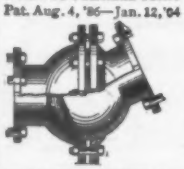

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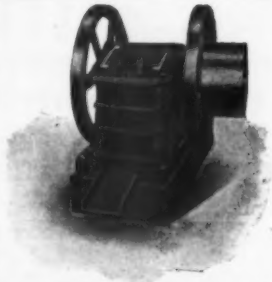

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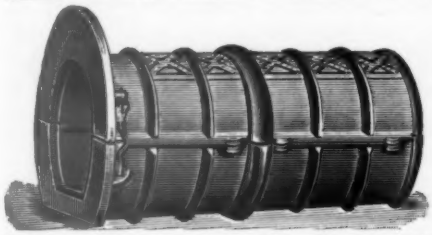

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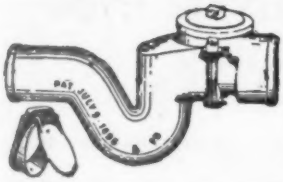

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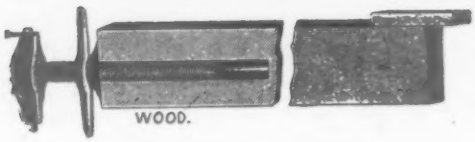

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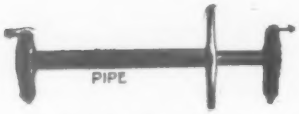

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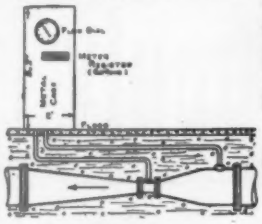

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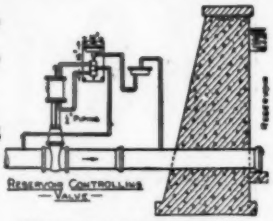

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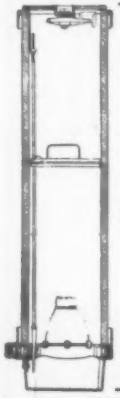

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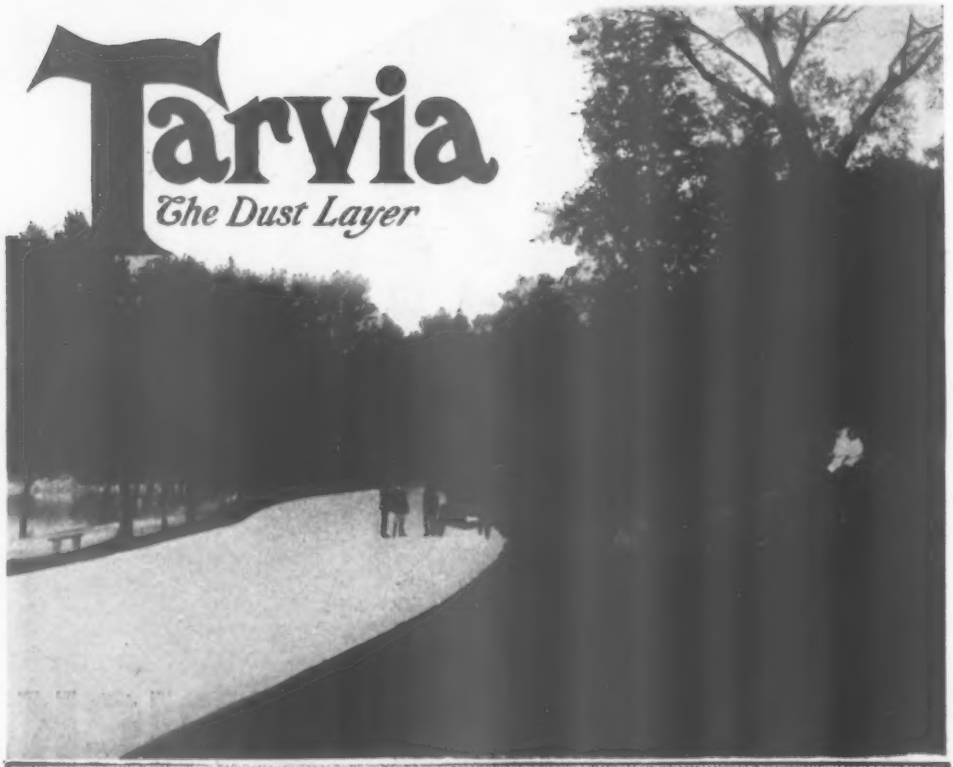

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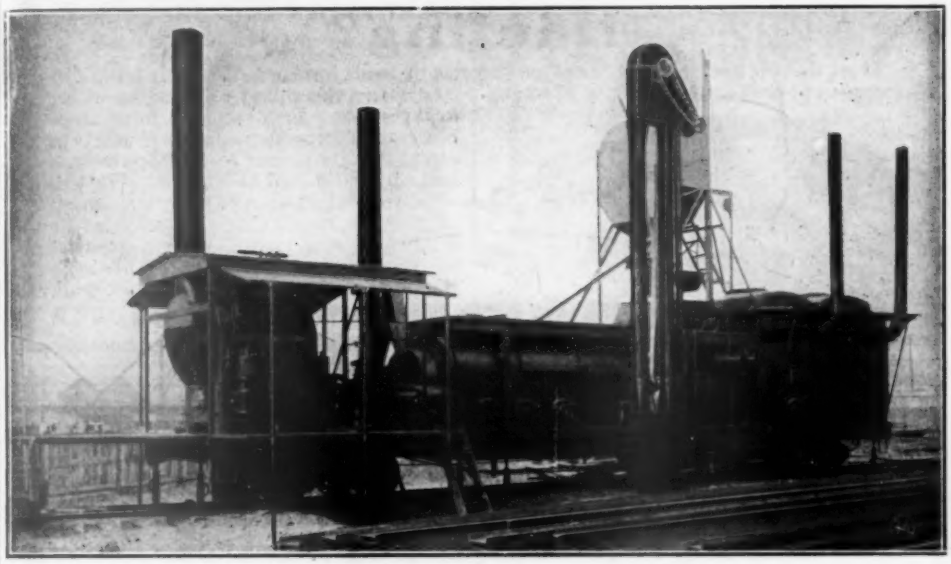
405 Blackwell Bldg., PITTSBURG, PA.



THIS IS THE HETHERINGTON ONE CAR RAILWAY PAVING PLANT

The Only Profitable Portable Plant Proposition Complete on One Car

MR. WM. DAMEWOOD, Esq., Care of R. F. CONWAY CO. October 3, 1908
Chamber Commerce Building, Chicago, Ill.

Dear Sir:—We are about to get out some new printed matter, and if you can do so without damage to your conscience, I will be glad if you will give me about six lines of testimony as to your experience with our One-Car Railway plant.

Very truly yours,
F. A. HETHERINGTON.

MR. F. A. HETHERINGTON, CHICAGO, October 11, 1908
Indianapolis, Indiana.

Dear Sir:—In reply to yours of 3d. I am only too glad to comply with your wishes. I can cheerfully say that your One-Car plant is the best plant of its type on the market.

On February 29th, 1908, I started laying topping and binder for a 70,000 yards contract in Oklahoma City. I completed the contract on May 29th and at 3 p. m. May 30th the plant was in transit for St. Paul. We made an AVERAGE of 24,000 yards per month. Our plant is now at Aurora, Illinois, and has travelled, since we purchased it, over 3,000 miles. We shipped it from Indianapolis to Joliet, from Joliet to Aurora, Aurora to Oklahoma City, Oklahoma City to St. Paul, St. Paul to Cedar Rapids, Iowa, from there to Joliet and from Joliet to Aurora where it is just completing 10,000 yards. Thence it will come to Chicago.

The plant is in good order. I have had a very good season here in Chicago with our Old Reliable. (This is a Hetherington Two-Car plant purchased several years ago.) This is the 10th year for the Two-Car plant and she is turning out more yardage each month than ever. Last Thursday we turned out 3,100 yards of 2″ topping, delivering the material 2¾ miles.

Trusting to hear from you again, I am,

Very truly yours,
WILLIAM DAMEWOOD.

This is what is being done by one of the best and most experienced asphalt paving contractors in the country. The reputation of The R. F. Conway Company for first-class work is excelled by none. They have probably had more experience with different makes of asphalt paving plants than any other contracting company excepting the one quoted below.

NOTE—From February 29th, 1908 to May 29th is ninety days. Deduct 13 Sundays and we have left 77 working days, making no allowance for stops on account of rain or other delays. In this time 70,000 yards were put down. This equals a daily average of 999 square yards for the One-Car plant. Any contractor will understand that during this time there must have been idle days on account of rain and from other causes. These we do not count, but if allowance were made the average would be considerably increased. IT IS AVERAGES THAT COUNT, not phenomenal one day runs.

ANOTHER

MR. F. A. HETHERINGTON, ENID, OKLA., October 10, 1908
Hetherington & Berner, Indianapolis, Ind.

Dear Sir:—In answer to your communication of October 3d, would say that the One-Car plant we are using here, manufactured by you, has given excellent satisfaction. We have frequently laid two thousand yards of one and one-half inch topping in ten hours. This, of course, with the use of the additional kettle.

Yours truly, WARNER-QUINLAN ASPHALT CO.
By W. A. Gruman, Supt.

The W-Q. Co. is known from coast to coast. No paving contractor has had a wider experience with all kinds of plants.

PLEASE TAKE NOTE—No paving contractor is in any way identified with the manufacture and sale of the HETHERINGTON plants. There are no "strings" to our letters of recommendation.

HETHERINGTON & BERNER—Paving Plant Builders—Indianapolis, Ind., U. S. A.

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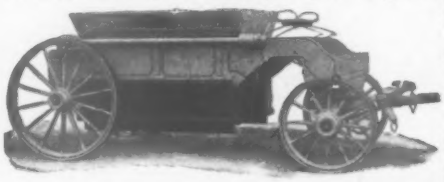
If so, do you keep careful "tab" on the size of loads hauled? There is a big difference not only in the capacity of wagon boxes but in the ability to stand up under heavy loads. Troy wagons have large boxes and an enormous factor of safety in strength. By actual test a Troy wagon has up held a load of 36 tons! We will send you full details of this test, which proves the claim that the Troy is the strongest wagon made. We will also send you our catalogue giving full details as to the construction of the Troy dump wagon.



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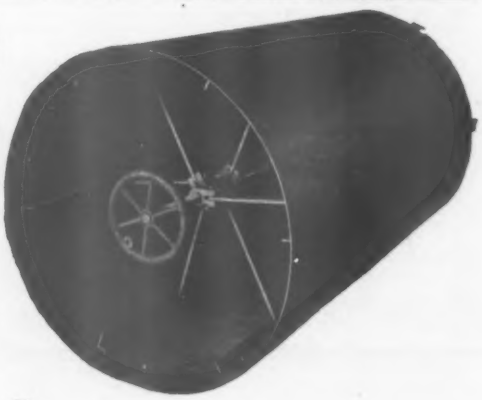

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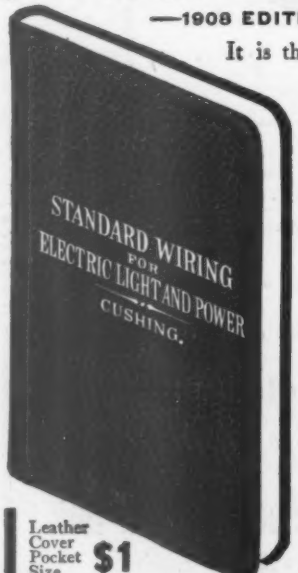

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When I was a boy, serving a molder's apprenticeship in my father's foundry, we had an old Scotch "cupola-tender" (iron melter) who used to say that he "needed nae help from a chemister mon."

Since those days I have come to appreciate the value of chemical science in the solution of the many complex problems that enter into modern foundry practice, but this sensible, practical old Scotchman's assertion of competence gained in the school of **experience**, has never been forgotten.

I take it for granted you are just as sensible and practical, and "need nae chemister mon" to tell you that **cast iron** culverts last **indefinitely.**

If you don't know it now you will certainly learn it after several years experience and many dollars wasted on the other kinds.

Did you ever hear of iron ore rusting or deteriorating in the ground?

Well, **cast** iron is only **one degree** removed from the ore.

That is why it **don't rust.**

When you have manipulated the metal until it is soft enough to roll into sheets or plates, you have changed it **chemically** (here is where the "chemister mon" comes in) and weakened its power to resist corrosion.

Furthermore, every process through which it passes increases its cost, and that is why **cast iron** is the **cheapest** metal culvert, pound for pound, you can use, to say nothing of its "everlastingness."

My short length, (3 ft.) **Cast Iron Pipe** is the logical, practical culvert.

It is light and easily handled (two men can handle a 24 inch pipe.)

There is no excess metal, yet it is strong enough to bear the heaviest loads.

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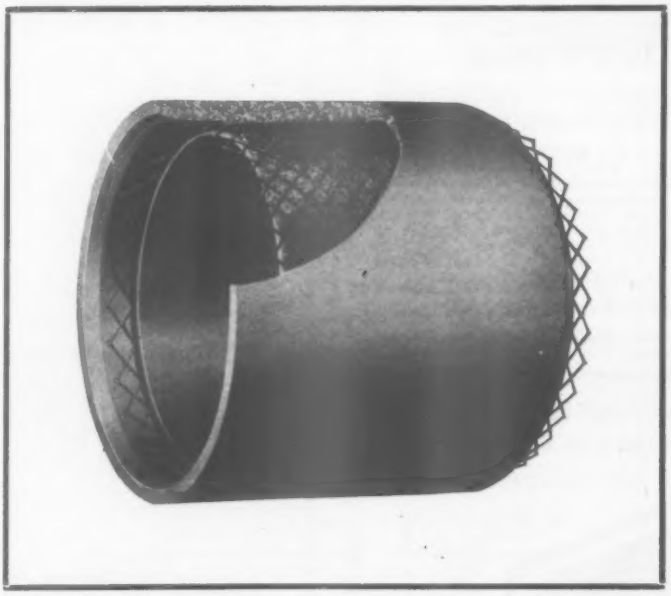

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For Reinforced Concrete

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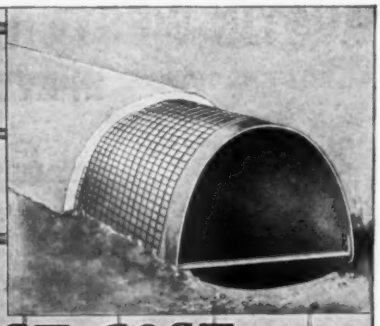

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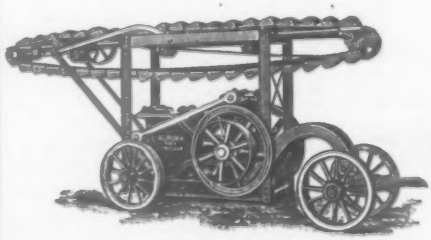

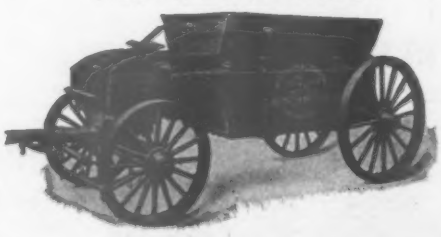

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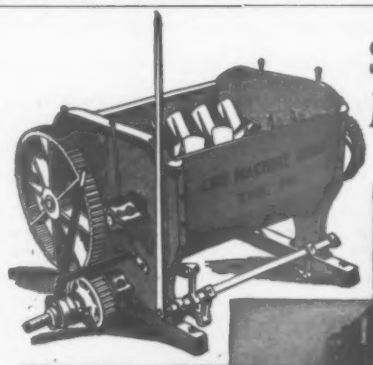

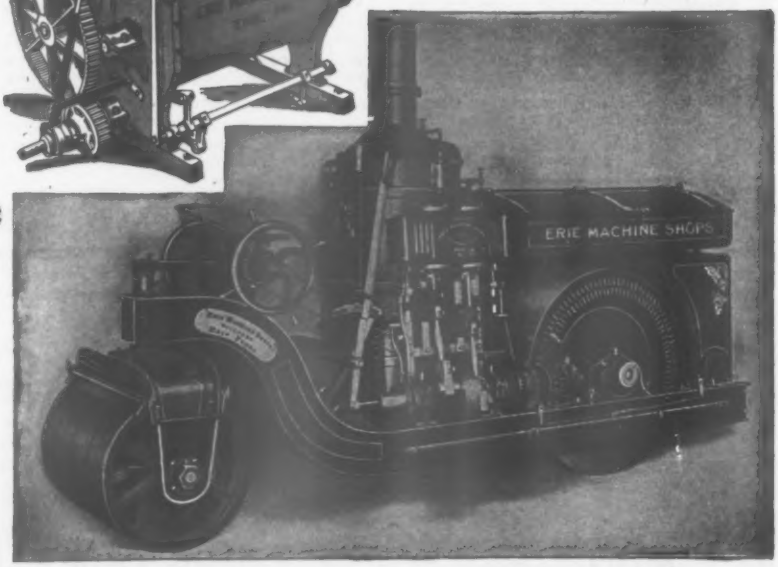

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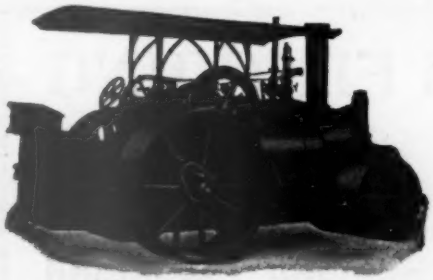

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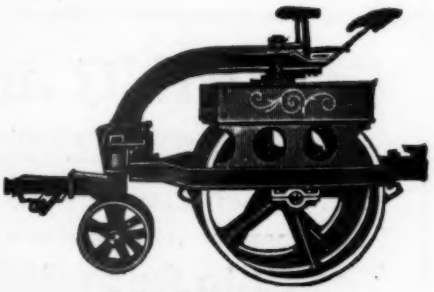

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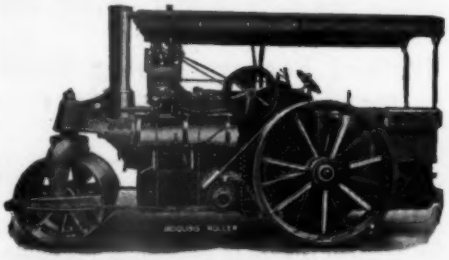

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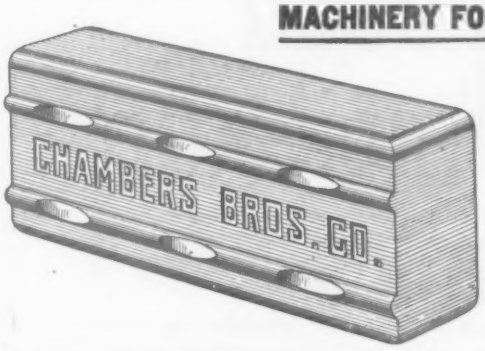

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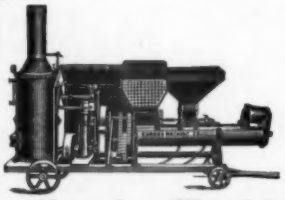

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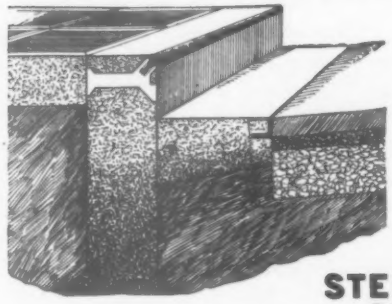

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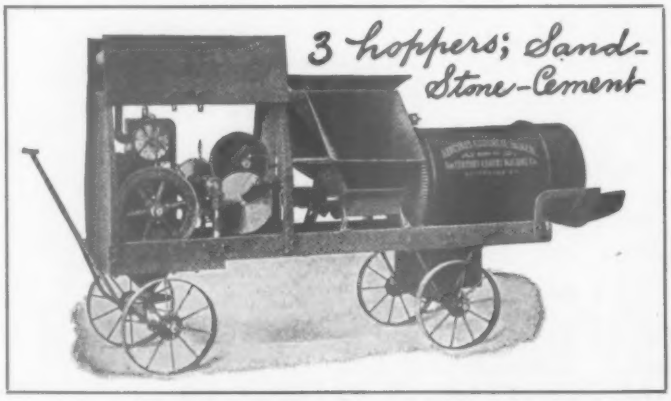

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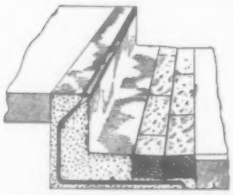

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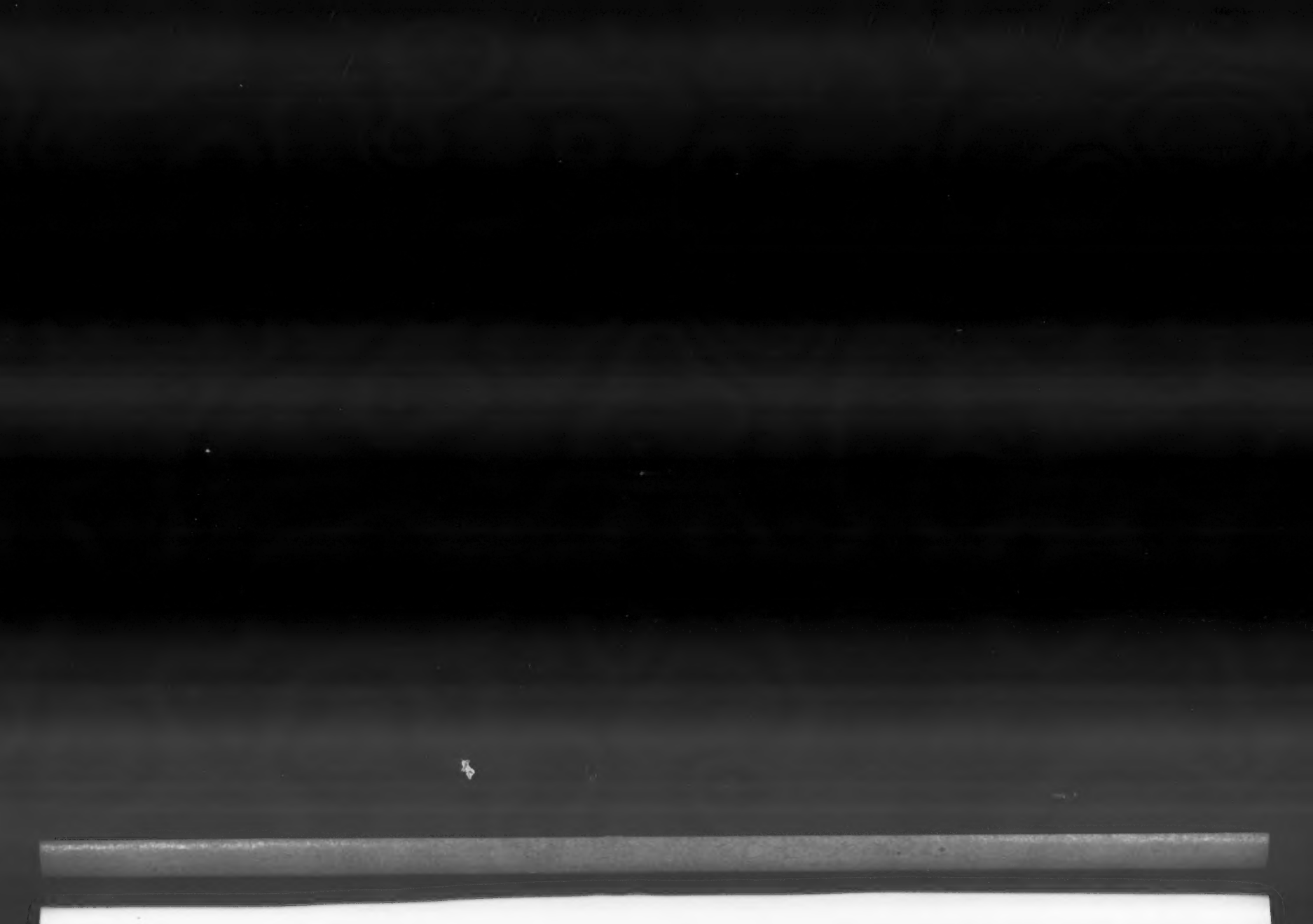

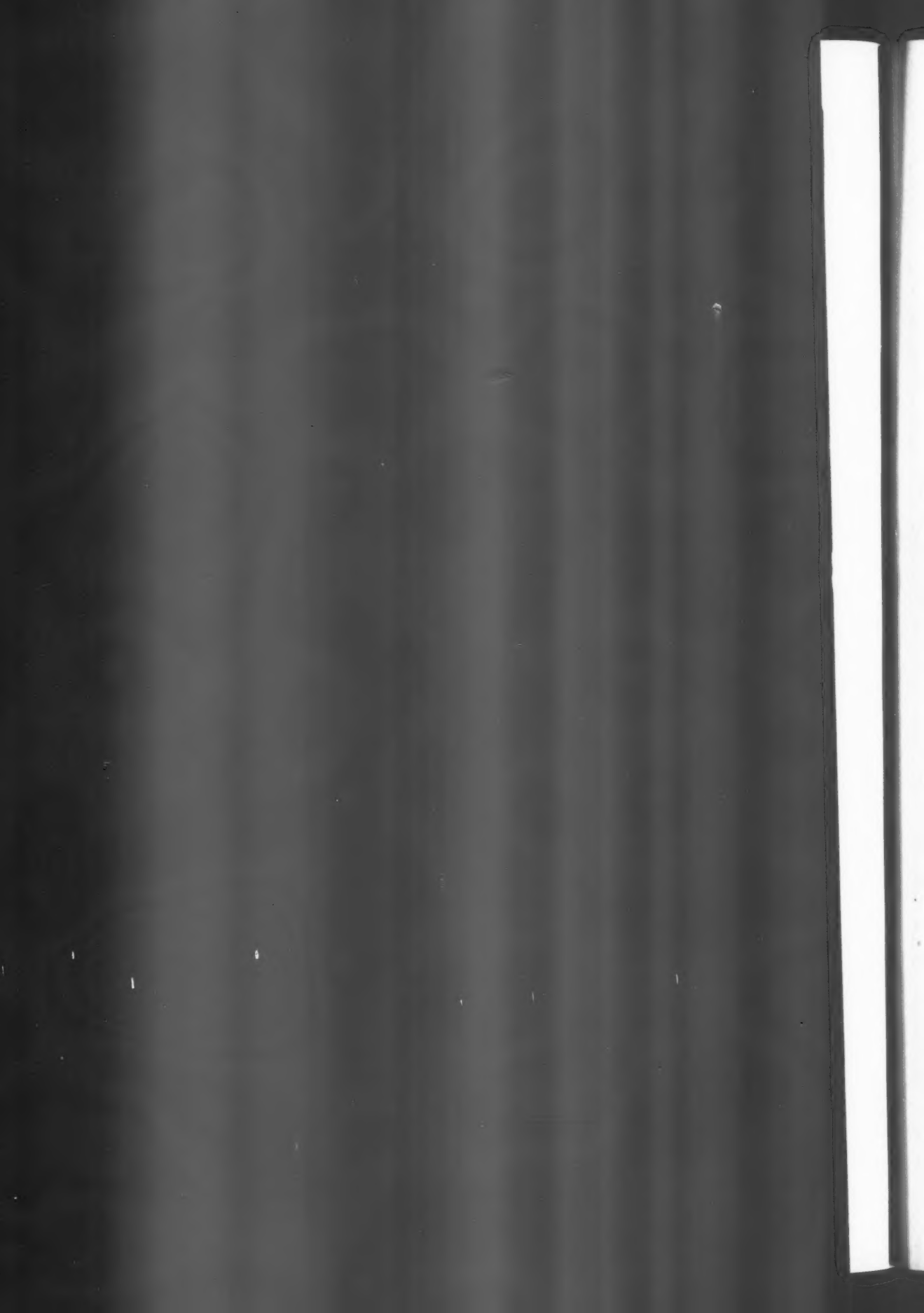

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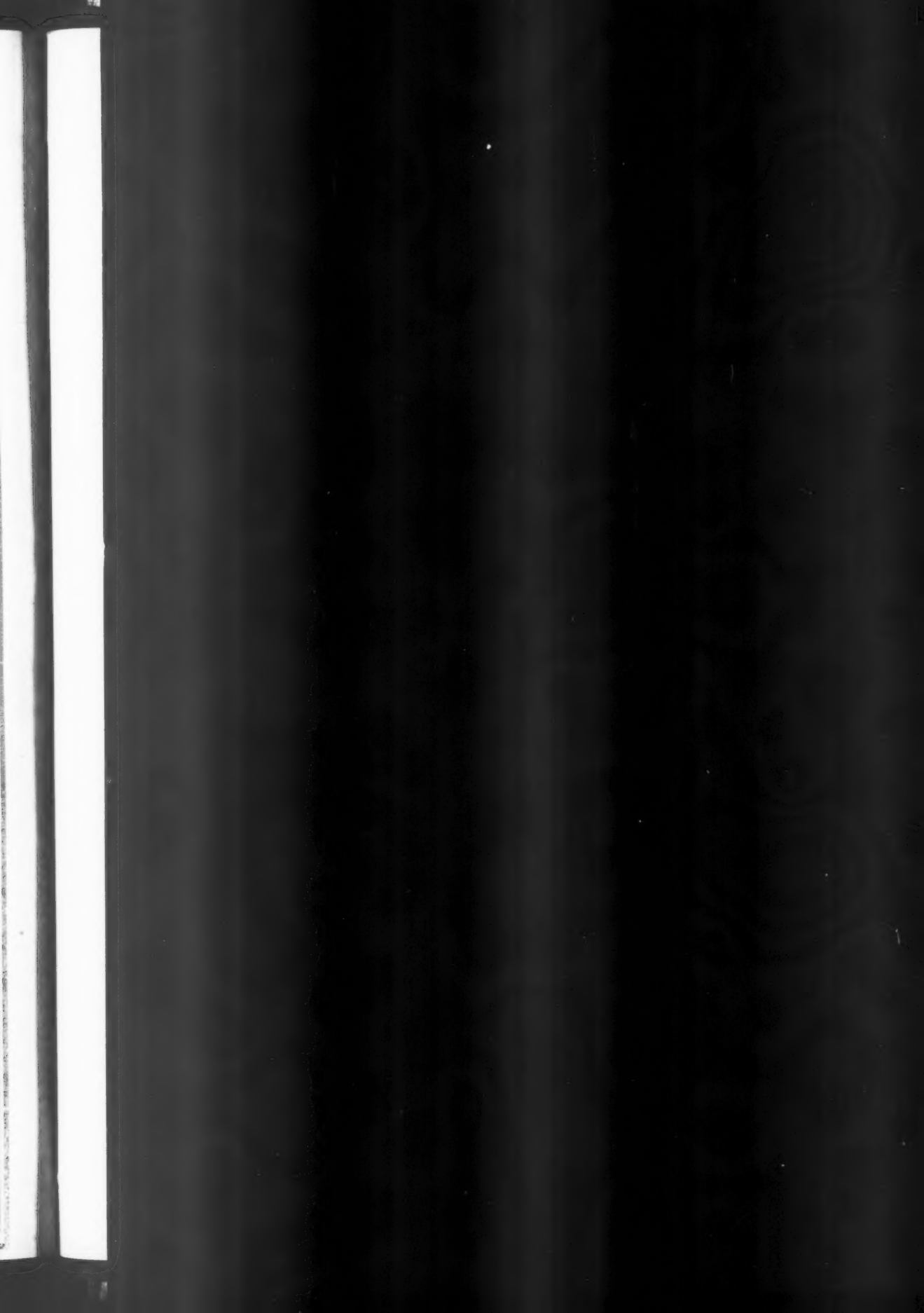

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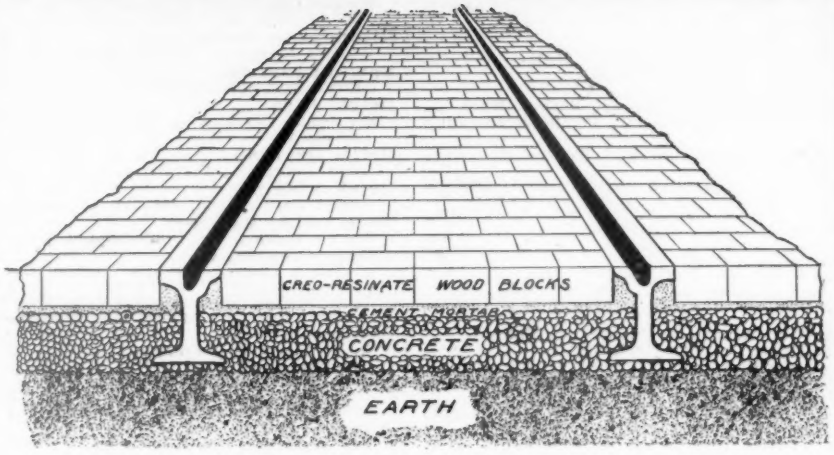

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Jas. H. Baker & Sons, Port Huron, Mich.
Rudolph S. Blome Co., Chicago, Ill.
Central Paving Co., Chicago, Ill.
City Wastes Disposal Co., New York City.
Geo. W. Clark, Wausau, Wis.
J. E. Conley & Co., Dayton, O.
Geo. W. Fife, Indianapolis, Ind.
Gilsonite Construction Co., St. Louis, Mo.
Hoosier Construction Co., Indianapolis, Ind.
Indiana Paving Brick & Block Co., Indianapolis, Ind.
L. T. McFarland, Van Wert, O.
J. E. Salfisberg & Co., Aurora, Ill
Sanitary Sewer Construction Co., Jackson, Mich.
John A. Spencer, Grinnell, Ia.
H. P. Streicher & Co., Toledo, O.
M. Tschirgi & Sons, Dubuque, Ia.

Contractors' Supplies.
The Browning Engineering Co., Cleveland, O.
Ohio Quarries Co., Cleveland, O.
Portsmouth Machine & Casting Co., Portsmouth, O.
Standard Asphalt & Rubber Co., Chicago, Ill.
St. Louis Crushed Quartz Co., St. Louis, Mo.
Schaeffer & Gengnagle, Dayton, O.
A. & S. Wilson, Pittsburg, Pa.

Contractors' Tools and Machinery.
Austin & Western Co., Ltd., Chicago, Ill.
The F. Bissell Co., Toledo, O.

The Browning Engineering Co., Cleveland, O.
The Conneaut Shovel Co., Conneaut, O.
Contractors' Tool Company, Philadelphia, Pa.
Koehring Machine Co., Milwaukee, Wis.
W. M. Toy & Co., Sidney, O.

Contractors' Wagons.
Austin-Western Co., Chicago, Ill.
Studebaker Bros. Mfg. Co., South Bend, Ind.
Troy Wagon Works Co., Troy, O.
D. S. Watson, Canastota, N. Y.

Conveyors.
Browning Engineering Co., Cleveland, O.
Carson Trench Machine Co., Boston, Mass.
The Jeffrey Mfg. Co., Columbus, O.
Link Belt Engineering Co., Philadelphia, Pa.

Creosote.
Barrett Mfg. Co., New York City.
F. J. Lewis Mfg. Co., Moline, Ill.
Republic Chemical & Creosoting Co., Indianapolis, Ind.
U. S. Wood Preserving Co., New York City.

Creosoted Wood Block.
Kettle River Quarries Co., Minneapolis, Minn.
Republic Chemical and Creosoting Co., Indianapolis, Ind.
U. S. Wood Preserving Co., New York City.

Crushers, Rock and Ore.
Austin & Western Co., Ltd., Chicago, Ill.
Geo. V. Cresson Co., Philadelphia, Pa.
Jeffrey Mfg. Co., Columbus, O.

Crushed Stone.
Cleveland Stone Co., Chicago, Ill.
Ohio Quarries Co., Cleveland, O.
St. Louis Crushed Quarts Co., St. Louis, Mo.

Culvert Pipe.
American Rolling Mill Co., Middletown, O.
Canton Culvert Co., Canton, O.
Lock Joint Pipe Co., New York City.
R. C. McWane, New York City.
Trussed Concrete Steel Co., Detroit, Mich.

Culvert Pipe, Cast Iron.
Feltz & East, Lima, O.
R. C. McWane, New York City.

Culvert Pipe, Vitrified.
W. E. Dee Clay Mfg. Co., Chicago, Ill.
Buckeye Fire Clay Co., Uhrichville, O.
East Ohio Sewer Pipe Co., Irondale, O.
Michigan Sewer Pipe Co., Jackson, Mich.
H. Stevens' Sons Co., Macon, Ga.
Terre Haute Brick & Pipe Co., Terre Haute, Ind.

Culverts.
American Rolling Mill Co., Middletown, O.
Canton Culvert Co., Canton, O.
Feltz & East Co., Lima, O.
R. C. McWane, New York City.

Curbing.
R. S. Blome Co., Chicago, Ill.
Cleveland Stone Company, Cleveland, O.
Ft. Scott Stone & Constr. Co., Ft. Scott, Kan.
Ohio Quarries Co., Cleveland, O.
Steel Protected Concrete Co., Philadelphia, Pa.
Warren Bros. Co., Boston, Mass.

Damp Course.
Barrett Mfg. Co., New York City.

Damp-Proofing.
Barrett Mfg. Co., New York City.

Dies.
Portsmouth Machine & Casting Co., Portsmouth, O.

Ditchers.
The Browning Engineering Co., Cleveland, O.

Drain Tile.
Boone Brick, Tile & Paving Co., Boone, Ia.
W. E. Dee Clay Mfg. Co., Chicago, Ill.
Michigan Paving Brick Co., Saginaw, Mich.
Michigan Sewer Pipe Co., Jackson, Mich.

Dryers.
Atlas Dryer Co., Cleveland, O.
F. D. Cummer & Son Co., Cleveland, O.
Iroquois Iron Works, Buffalo, N. Y.
Ruggles-Coles Engineering Co., New York City.

Dump Wagons.
Austin-Western Co., Chicago, Ill.
Studebaker Bros. Mfg. Co., South Bend, Ind.
Troy Wagon Works Co., Troy, O.
Watson Wagon Co., Canastota, N. Y.

Duplex Brick Clamp.
Duplex Foundry and Mfg. Co., Cleveland, O.

Dust Layers.
Barrett Mfg. Co., New York City.

Dust Laying Compound.
Barrett Mfg. Co., New York City.
Impervious Product Co., Baltimore, Md.
F. J. Lewis Mfg. Co., Moline, Ill.
Standard Asphalt & Rubber Co., Chicago, Ill.

Electrical Engineers.
H. Whitford Jones, Cleveland, O.
Osborn Engineering Co., Cleveland, O.

Electrical Insulation.
Standard Asphalt & Rubber Co., Chicago, Ill.

Electrolytic Investigations.
Dabney H. Maury, Peoria, Ill.

Engineering Instruments.
Bausch-Lomb Optical Co., Rochester, N. Y.
Lufkin Rule Co., Saginaw, Mich.

Excavators.
The Browning Engineering Co., Cleveland, O.

Expansion Joints.
Barrett Mfg. Co., New York City.
A. L. Holmes, Grand Rapids, Mich.
Standard Asphalt & Rubber Co., Chicago, Ill.

Expanded Metal Construction.
R. S. Blome Co., Chicago, Ill.
Expanded Metal & Corrugated Bar Co., St. Louis, Mo.

Filler.
American Asphaltum & Rubber Co., Chicago, Ill.
Barrett Manufacturing Co., New York City.
Impervious Product Co., Baltimore, Md.
F. J. Lewis Mfg. Co., Moline, Ill.
Standard Asphalt & Rubber Co., Chicago, Ill.
Sun Co., Philadelphia, Pa.

Filler Asphalt.
Standard Asphalt & Rubber Co., Chicago, Ill.

Fire Alarm Telegraph.
Gamewell Fire Alarm Telegraph Co., New York.

Fire Brick.
Clearfield Clay Working Co., Clearfield, Pa.
F. B. Holmes & Co., Detroit, Mich.
Michigan Paving Brick Co., Saginaw, Mich.
Michigan Sewer Pipe Co., Jackson, Mich.
H. Stevens' Sons Co., Macon, Ga.

Fire Clay Products.
Buckeye Fire Clay Co., Urichville, O.
Clearfield Clay Working Co., Clearfield, Pa.
W. E. Dee Clay Mfg. Co., Chicago, Ill.
F. B. Holmes & Co., Detroit, Mich.
Michigan Paving Brick Co., Saginaw, Mich.
Michigan Sewer Pipe Co., Jackson, Mich.
H. Stevens' Sons Co., Macon, Ga.

Fire Proof Construction.
R. S. Blome Co., Chicago, Ill.
Expanded Metal & Corrugated Bar Co., St. Louis, Mo.

Fixers.
Barrett Mfg. Co., New York City.
Standard Asphalt & Rubber Co., Chicago, Ill.

Flue Liners.
W. E. Dee Clay Mfg. Co., Chicago, Ill.
Lewis McNutt, Brazil, Ind.

Flush Tanks.
Pacific Flush Tank Co., Chicago, Ill.

Forging-Steel.
Krupp (Thos. Prosser & Son, New York City).

Foundation, Concrete.
R. S. Blome Co., Chicago, Ill.

Foundations, Bituminous Concrete.
Barrett Mfg. Co., New York City.

Garbage Disposal Plants.
City Wastes Disposal Co., New York City.
New York Sewage Disposal Co., New York City.
Power Specialty Co., New York City.

Gas Engineers.
Carl Von Hartzfelt, Wheeling W. Va.
Frank D. Moses, Trenton, N. J.
Wm. D. Marks, New York City.

Gas Pipe.
McWane Pipe Works, New York City.

Gas Works.
Frank D. Moses, Trenton, N. J.

Gold Dredging Machinery.
Link-Belt Co., Philadelphia, Pa.

Granitoid Concrete Block Pavement.
Rudolph S. Blome Co., Chicago, Ill.

Gum Paints and Varnish.
Standard Asphalt & Rubber Co., Chicago, Ill.

Hoisters.
Potter Mfg. Co., Indianapolis, Ind.

Hoisting Machinery.
Jeffrey Mfg. Co., Columbus, O.

Hollow Building Blocks.
Lewis McNutt, Brazil, Ind.

Hydraulic Cement.
Meacham & Wright, Chicago, Ill.
Utica Hydraulic Cement Co., Utica, Ill.

Hydrolene.
Sun Co., Philadelphia, Pa.

BUSINESS DIRECTORY—CONTINUED.

Impregnating Gums.
Barrett Mfg. Co., New York City.
Standard Asphalt & Rubber Co., Chicago, Ill.

Inspection of Buildings.
Lehigh Valley Testing Laboratory, Allentown, Pa.
Osborn Engineering Co., Cleveland, O.

Inspection of Structural Materials.
Lehigh Valley Testing Laboratory, Allentown, Pa.
Osborn Engineering Co., Cleveland, O.
H. Whitford Jones, Cleveland, O.

Insulating Gums and Compounds.
Standard Asphalt & Rubber Co., Chicago, Ill.

Insulating Material.
Barrett Mfg. Co., New York City.
Standard Asphalt & Rubber Co., Chicago, Ill.

Iron Paints.
Barrett Mfg. Co., New York City.
Standard Asphalt & Rubber Co., Chicago, Ill.

Laboratory.
Lehigh Valley Testing Laboratory, Allentown, Pa.
Meade Testing Laboratories, Nazareth, Pa.
Osborn Engineering Co., Cleveland, O.
Henry S. Spackman Engineering Co., Philadelphia, Pa.

Landscape Engineers.
Mason L. Brown, Detroit, Mich.

Lift Magnets.
The Browning Engineering Co., Cleveland, O.

Lime Kilns.
F. L. Smidth & Co., New York City.

Locomotive Cranes.
The Browning Engineering Co., Cleveland, O.

Macadamizing.
Granite City Lime & Cement Co., Granite City, Ill.
Warren Bros. Co., Boston, Mass.

Mastic.
Standard Asphalt & Rubber Co., Chicago, Ill.

Mastic Floors.
Barrett Mfg. Co., New York City.
Standard Asphalt & Rubber Co., Chicago, Ill.

Mechanical Engineers.
Osborn Engineering Co., Cleveland, O.
Dabney H. Maury, Peoria, Ill.

Meters.
Buffalo Meter Co., Buffalo, N. Y.
Simplex Valve and Meter Co., Philadelphia, Pa.

Meter Boxes.
H. W. Clark, Mattoon, Ill.
Ford Meter Box Co., Hartford City, Ind.
Grand Rapids Meter Box Co., Grand Rapids, Mich.

Mineral Rubber.
American Asphaltum and Rubber Co., Chicago, Ill.
F. J. Lewis Mfg. Co., Moline, Ill.
Standard Asphalt & Rubber Co., Chicago, Ill.

Mineral Rubber Pipe Dip & Coatings.
Standard Asphalt & Rubber Co., Chicago, Ill.

Municipal Accounting.
Adolphe Rafter, New York City.

Municipal Lighting.
Barron-Collier Co., Memphis, Tenn.

Non-Staining Cement.
Meacham & Wright, Chicago, Ill.

Paint and Varnish Gums.
Standard Asphalt & Rubber Co., Chicago, Ill.

Paints.
Barrett Mfg. Co., New York City.
Standard Asphalt & Rubber Co., Chicago, Ill.

Paints, Iron.
Barrett Mfg. Co., New York City.
Standard Asphalt & Rubber Co., Chicago, Ill.

Pans.
Portsmouth Machine & Casting Co., Portsmouth, O.

Pavement Expert.
J. W. Howard, New York City.

Pavements.
Rudolph S. Blome Co., Chicago, Ill.
Standard Asphalt & Rubber Co., Chicago, Ill.

Paving Blocks.
Boone Brick, Tile & Paving Co., Boone, Ia.
The Buckeye Brick & Block Co., Zanesville, Ohio.
Carlyle Paving Brick Co., Portsmouth, O.
Clinton Paving and Building Brick Company, Clinton, Ind.
Danville Brick Co., Danville, Ill.
Kettle River Quarries Co., Minneapolis, Minn
Logan Brick Mfg. Co., Toledo, O.
Metropolitan Paving Brick Co., Canton, O.
Michigan Paving Brick Co., Saginaw, Mich.
Peebles Paving Brick Co., Portsmouth, O.
Purington Paving Brick Co., Galesburg, Ill.
Saginaw Paving Brick Co., Saginaw, E. S., Mich.
Springfield Paving Brick Co., Springfield, Ill.
The Wassal Brick Co., Glouster, O.
U. S. Wood Preserving Co., New York City.

Paving Blocks, Creosoted.
F. J. Lewis Mfg. Co., Moline, Ill.
Kettle River Quarries Co., Minneapolis, Minn.
U. S. Wood Preserving Co., Moline, Ill.

Paving Brick.
Boone Brick, Tile & Paving Co., Boone, Ia.
The Buckeye Brick & Block Co., Zanesville, Ohio.
Carlyle Paving Brick Co., Portsmouth, O.
Clearfield Clay Working Co., Clearfield, Pa.
Clinton Paving and Building Brick Co., Clinton, Ind.
Collinwood Shale Brick Co., Collinwood, O.
Danville Brick Co., Danville, Ill.
F. B. Holmes & Co., Detroit, Mich.
Kentucky Vitrified Brick Co., Louisville, Ky.
Logan Brick Mfg. Co., Toledo, O.
Metropolitan Paving Brick Co., Canton, O.
Michigan Paving Brick Co., Saginaw, Mich.
National Paving Brick Manufacturers Association, Terre Haute, Ind.
Peebles Paving Brick Co., Portsmouth, O.
Purington Paving Brick Co., Galesburg, Ill.
Saginaw Paving Brick Co., Saginaw, E. S., Mich.
Springfield Paving Brick Co., Springfield, Ill.
Terre Haute Brick and Pipe Co., Terre Haute, Ind.
Wabash Clay Mfg. Co., Veedersburg, Ind.
The Wassal Brick Co., Glouster, O.

Paving Brick Association.
National Paving Brick Manufacturers Association, Terre Haute, Ind.

Paving Brick Machinery.
Atlas Dryer Co., Cleveland, O.
Chambers Bros. Co., Philadelphia, Pa.

Paving Castings.
Portsmouth Machine & Casting Co., Portsmouth, O.

Paving, Cement Sidewalk.
R. S. Blome Co., Chicago, Ill.

Paving Contractors.
T. J. Backus Construction Co., Dayton, O.
Jas. H. Baker & Son, Port Huron, Mich.
Central Paving Co., Chicago, Ill.
Geo. W. Clark, Wausau, Wis.
R. S. Blome Co., Chicago, Ill.
Gilsonite Construction Co., St. Louis, Mo.
Hoosier Construction Co., Indianapolis, Ind.
Indiana Paving Brick and Block Co., Indianapolis, Ind.
Sicilian Asphalt Co., New York City.
H. P. Streicher & Co., Toledo, O.
Western Construction Co., Lafayette, Ind.
Warren Asphalt Paving Co., Cambridge, Mass.

Paving Filler.
Barrett Manufacturing Co., New York City.
F. J. Lewi Mfg. Co., Moline, Ill.

Paving Materials.
Barrett Mfg. Co., New York City.
Granite City Lime & Cement Co., Granite City, Ill.
Standard Asphalt & Rubber Co., Chicago, Ill.

Paving Pitch.
Barrett Mfg. Co., New York City.
F. J. Lewis Mfg. Co., Moline, Ill.
Michigan Paving Brick Co., Saginaw, Mich.

Paving Tools.
P. F. Connelly, El Reno, Okla.
Contractors' Tool Company, Philadelphia, Pa.
Iroquois Iron Works, Buffalo, N. Y.

Pipe Coatings.
American Asphaltum and Rubber Co., Chicago, Ill.
Barrett Mfg. Co., New York City.
F. J. Lewis Mfg. Co., Moline, Ill.
Standard Asphalt & Rubber Co., Chicago, Ill.

Pipe Dip.
Barrett Mfg. Co., New York City.
Standard Asphalt & Rubber Co., Chicago, Ill.

Pipe Dip and Coatings.
Barrett Mfg. Co., New York City.
Standard Asphalt & Rubber Co., Chicago, Ill.

Pipe Manufacturers.
McWane Pipe Works, New York City.

Pitch.
Barrett Mfg. Co., New York City.
F. J. Lewis Mfg. Co., Moline, Ill.

BUSINESS DIRECTORY—CONTINUED.

Pitch Filler.
Barrett Mfg. Co., New York City.

Portland Cement.
Alma Cement Co., Wellston, O.
Alpha Portland Cement Co., Alpha, N. J.
Alsen's Am. Portland Cement Co., New York City.
Atlas Portland Cement Co., New York City.
Chicago Portland Cement Co., Chicago, Ill.
Dexter Portland Cement Co., Philadelphia, Pa.
French, Samuel H. & Co., Philadelphia, Pa.
Gabriel & Schall, New York City.
F. B. Holmes & Co., Detroit, Mich.
Kansas Portland Cement Co., Iola, Kans.
Kosmos Portland Cement Co., Louisville, Ky.
Lesley & Trinkle, Philadelphia, Pa.
Lehigh Portland Cement Co., Allentown, Pa.
Marquette Cement Mfg. Co., Chicago, Ill.
Meacham & Wright, Chicago, Ill.
Northampton Portland Cement Co., N. Y. City.
Omega Portland Cement Co., Jonesville, Mich.
Peninsular Portland Cement Co., Jackson, Mich.
St. Louis Portland Cement Co., St. Louis, Mo.
Superior Portland Cement Co., Charleston, W. Va.
Universal Portland Cement Co., Chicago, Ill.
Charles Warner & Co., New York.
Charles Warner Co., Wilmington, Del.
Western States Port. Cem. Co., Independence, Kan.
Wolverine Portland Cement Co., Coldwater, Mich.
Wyandotte Portland Cement Co., Wyandotte, Mich.

Power Transmission.
Geo. V. Cresson Co., Philadelphia, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link Belt Engineering Co., Philadelphia, Pa.

Presses.
Portsmouth Machine & Casting Co., Portsmouth, O.

Pumps.
Harris Air Pump Co., Indianapolis, Ind.

Railroad Specialists.
Krupp (Thos. Prosser & Son, New York City.)

Rapid Calculation.
C. C. Brain, New York City.

Reinforced Concrete Sewers.
Adjustable Steel Centering Co., Fond du Lac, Wis.
Lock Joint Pipe Co., New York City.
Reinforced Concrete Pipe Co., Jackson, Mich.
Trussed Concrete Steel Co., Detroit, Mich.

Reservoirs, Concrete.
R. S. Blome Co., Chicago, Ill.

Road Culverts.
American Rolling Mill Co., Middletown, O.
Canton Culvert Co., Canton, O.
Feltz & East, Lima, O.
R. C. McWane, New York City.

Road Oils.
Barrett Mfg. Co., New York City.
Standard Asphalt & Rubber Co., Chicago, Ill.

Road Machinery.
Austin & Western Co., Ltd., Chicago, Ill.
Buffalo Steam Roller Co., Buffalo, N. Y.

Road Rollers.
Austin & Western Co., Ltd., Chicago, Ill.
Buffalo Steam Roller Co., Buffalo, N. Y.
Enterprise Mfg. Co., Columbiana, O.
Erie Machine Shop, Erie, Pa.
Iroquois Iron Works, Buffalo, N. Y.
Kelley-Springfield Road Roller Co., Springfield, O.

Road Tar.
Barrett Mfg. Co., New York City.

Rock Crushers.
Austin & Western Co., Ltd., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.

Rock Drills.
Jeffrey Mfg. Co., Columbus, O.

Roofing.
Barrett Mfg. Co., New York City.
General Asphalt Products Supply Agency, New York City.
F. J. Lewis Mfg. Co., Moline, Ill.
Standard Asphalt & Rubber Co., Chicago, Ill.
Warren Brothers Company, Boston, Mass.

Roofing Material.
American Asphaltum & Rubber Co., Chicago, Ill.
Barrett Mfg. Co., New York City.
F. J. Lewis Mfg. Co., Moline, Ill.
Standard Asphalt & Rubber Co., Chicago, Ill.
Warren Brothers Company, Boston, Mass.

Rope Transmission.
Geo. V. Cresson Co., Philadelphia, Pa.
The Jeffrey Mfg. Co., Columbus, O.

Sand.
Granite City Lime & Cement Co., Granite City, Ill.

Sand Dryers.
F. D. Cummer & Son, Cleveland, O.

Sanitary Engineers.
New York Sewage Disposal Co., New York City.

Sarco.
Standard Asphalt & Rubber Co., Chicago, Ill.

Scrapers.
Austin & Western Co., Chicago, Ill.
W. M. Toy & Co., Sidney, O.

Screens.
Portsmouth Machine & Casting Co., Portsmouth, O.

Sewage Disposal.
City Wastes Wastes Disposal Co., New York City.
New York Sewage Disposal Co., New York City.
Power Specialty Co., New York City.

Sewer Braces.
Kalamazoo Foundry & Machine Co., Kalamazoo, Mich.
The Potter Mfg. Co., Indianapolis, Ind.

Sewer Castings.
Portsmouth Machine & Casting Co., Portsmouth, O.

Sewer Contractors.
T. J. Backus Construction Co., Dayton, O.
The Potter Mfg. Co., Indianapolis, Ind.
Sanitary Sewer Construction Co., Jackson, Mich.
H. P. Streicher & Co., Toledo, O.

Sewer Machines.
Potter Mfg. Co., Indianapolis, Ind.

Sewer Pipe.
P. Bannon Sewer Pipe Co., Louisville, Ky.
Buckeye Fire Clay Co., Urichsville, O.
W. E. Dee Clay Mfg. Co., Chicago, Ill.
F. B. Holmes & Co., Detroit, Mich.
Lewis McNutt, Brazil, Ind.
Michigan Sewer Pipe Co., Jackson, Mich.
Reinforced Concrete Pipe Co., Jackson, Mich.
Schaeffer & Gengnagel, Dayton, O.
H. Stevens' Sons Co., Macon, Ga.

Sewer Rods.
The F. Bissell Co., Toledo, O.

Sewer Trap.
Perfect Sewer Trap Mfg. Co., New York City.

Sheet Contractors' Supplies.
Standard Asphalt & Rubber Co., Chicago, Ill.

Shovels.
The Conneaut Shovel Co., Conneaut, O.

Sidewalk Tools.
P. F. Connelly, El Reno, Okla.

Sprinkling Wagons.
Austin & Western Co., Ltd., Chicago, Ill.
E. D. Etnyre & Co., Oregon, Ill.
Studebaker Bros. Mfg. Co., South Bend, Ind.

Standard Rattlers.
Tinius Olsen & Co., Philadelphia, Pa.

Steam Shovels.
The Browning Engineering Co., Cleveland, O.

Steel Centerings.
Adjustable Steel Centering Co., Fond du Lac, Wisc.

Steel Tape.
Lufkin Rule Co., Saginaw, Mich.

Stone Pavements.
Cleveland Stone Co., Cleveland, O.
Ohio Quarries Co., Chicago, Ill.

Street Contractors' Supplies.
Austin & Western Co., Ltd., Chicago, Ill.
J. S. Barron, New York City.
Iroquois Iron Works, Buffalo, N. Y.
Kelly-Springfield Road Roller Co., Springfield, O.

Street Crossings.
Cleveland Stone Co., Chicago, Ill.

Street Lighting.
Barron-Collier Co., Memphis, Tenn.

Street Scrapers.
Austin & Western Co., Ltd., Chicago, Ill.
W. M. Toy & Co., Sidney, O.

Street Sweepers.
Austin & Western Co., Ltd., Chicago, Ill.
J. S. Barron, New York City.
Studebaker Bros. Mfg. Co., South Bend, Ind.

Surveyors' Instruments.
Bausch-Lomb Optical Co., Rochester, N. Y.

Surveyors.
The Brotherton Co., Escanaba, Mich.

Tar and Pitch.
Barrett Mfg. Co., New York City.

Tar, Coal.
Barrett Mfg. Co., New York City.

Taroline.
F. J. Lewis Mfg. Co., Moline, Ill.
Tar Products.
Barrett Mfg. Co., New York City.
Tar, Road.
Barrett Mfg. Co., New York City.
Tarvia.
Barrett Mfg. Co., New York City.
Testing Chemists.
Dow & Smith, New York City.
J. W. Howard, New York City.
Henry S. Spackman Engineering Co., Philadelphia, Pa.
Lehigh Valley Testing Laboratory, Allentown, Pa
Meade Testing Laboratories, Nazareth, Pa.
Henry S. Spackman Engineering Co., Philadelphia, Pa.
Testing Laboratories.
J. W. Howard, New York City.
R. W. Hunt & Co., Chicago, Ill.
Lehigh Valley Testing Laboratory, Allentown, Pa.
Meade Testing Laboratories, Nazareth, Pa.
Osborn Engineering Co., Cleveland, O.
Henry S. Spackman Engineering Co., Philadelphia, Pa.
Tinius Olsen & Co., Philadelphia, Pa.
Testing Machinery.
Tinius Olsen & Co., Philadelphia, Pa.
Transmission Outfits.
Geo. V. Cresson Co., Philadelphia, Pa.
The Jeffrey Mfg. Co., Columbus, O.
Trench Machines.
The Potter Mfg. Co., Indianapolis, Ind.
Tube Mills.
Krupp (Thos. Prosser & Son, New York City.)
F. L. Smidth & Co., New York City.
Valves.
Simplex Valve and Meter Co., Philadelphia, Pa.
Varnish Gums.
Standard Asphalt & Rubber Co., Chicago, Ill.
Water Pipe.
Lock Joint Pipe Co., New York City.
McWane Pipe Works, New York City
Reinforced Concrete Pipe Co., Jackson, Mich.
Water Pipe Joints.
A. L. Holmes, Grand Rapids, Mich.
Waterproofing.
American Asphaltum & Rubber Co., Chicago, Ill.
Barrett Mfg. Co., New York City.
General Asphalt Products Supply Agency, New York City.
Sandusky Portland Cement Co., Sandusky, O.
Standard Asphalt & Rubber Co., Chicago, Ill.
Waterproofing for Cement.
Barrett Mfg. Co., New York City.
Standard Asphalt & Rubber Co., Chicago, Ill.
Waterproofing for Concrete.
Barrett Mfg. Co., New York City.
Standard Asphalt & Rubber Co., Chicago, Ill.
Water Meters.
Buffalo Meter Co., Buffalo, N. Y.
Simplex Valve and Meter Co., Philadelphia, Pa.
Water Meter Boxes.
H. W. Clark, Mattoon, Ill.
Ford Meter Box Co., Hartford City, Ind.
Grand Rapids Meter Box Co., Grand Rapids, Mich.
Waterworks Supplies.
Buffalo Meter Co., Buffalo, N. Y.
Ford Meter Box Co., Hartford City, Ind.
Harris Air Pump Co., Indianapolis, Ind.
Lock Joint Pipe Co., New York City.
McWane Pipe Works, New York City.
Reinforced Concrete Pipe Co., Jackson, Mich.
Wheelbarrows.
Austin & Western Co., Ltd., Chicago, Ill.
Portsmouth Machine & Casting Co., Portsmouth, O.
Wheel Scrapers.
Austin & Western Co., Ltd., Chicago, Ill.
Wire Screens.
Portsmouth Machine & Casting Co., Portsmouth, O.
Wood Grapples.
The Browning Engineering Co., Cleveland, O.
Wood Pavements.
Kettle River Quarries Co., Minneapolis, Minn
Republic Chemical & Creosoting Co., Indianapolis, Ind.
U. S. Wood Preserving Co., New York City.
Wood Preservatives.
Barrett Mfg. Co., New York City.
F. J. Lewis Mfg. Co., Moline, Ill.
Wood Split Pulley.
The Jeffrey Mfg. Co., Columbus, O.

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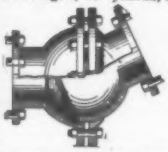

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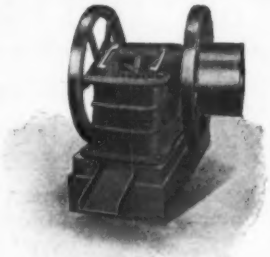

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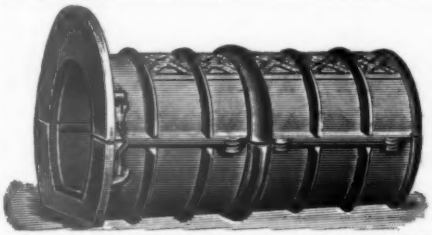

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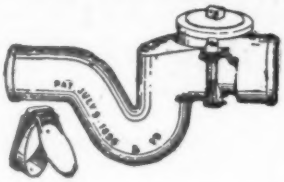

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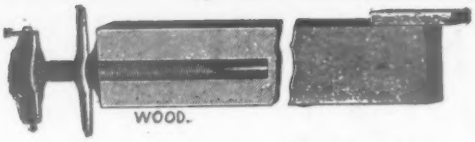

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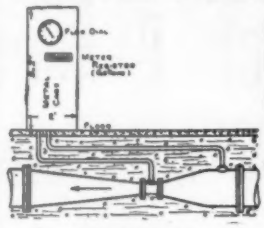

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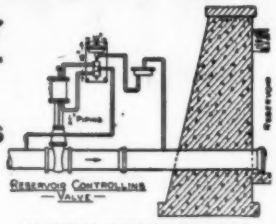

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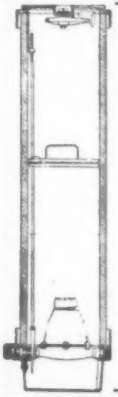

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112 SOUTH HIGH STREET, HARTFORD CITY, IND.

BUILDERS IRON FOUNDRY, Providence, R. I., Sales Agents for New England

INFRINGEMENT NOTICE

THE CLARK METER BOX has met with wonderful success. Is it any wonder that it is imitated? Our boxes are now in use throughout the entire country and they are giving perfect satisfaction everywhere. Thousands in use by THE UNITED STATES GOVERNMENT.

We wish to advise our many friends and patrons that our goods are well protected by patents and institution of legal proceedings have been commenced to protect our rights. All infringing MANUFACTURERS and USERS will be prosecuted to the fullest extent of the law.

Let us tell you about our IRON COLLAPSIBLE FORM for the manufacture of CONCRETE METER BOX Bodies, at one-fourth the cost of any other box body. Our TEKSAGON (No Gasket) Meter Coupling is a wonder. Costs no more than ordinary coupling.

Drop us a postal card for catalogue.

H. W. CLARK CO., 1512 Broadway, Mattoon, Ill.

BOXES FOR WATER METERS

We make a complete and finished meter box, including all pipes in place and meter connections, frost-proof, air-tight, water-proof, for $3.00.

Durable—no expense to maintain—easily accessible for reading or removing the meter; protected from interference or injury.

WRITE US

THE GRAND RAPIDS METER BOX CO.

574 Wealthy Avenue Grand Rapids, Mich.

ACCURATE AND DURABLE

WATER METERS

with standard six-hand or straight reading dials, indicating in cubic feet, gallons or liters. Also meters for fuel oil, or other liquids.

BUFFALO METER CO.

290 Terrace, Buffalo, N. Y.

ESTABLISHED 1892.

BITU-MINERAL
PAVING CEMENT

Is the only paving cement on the market that will produce bituminous streets that are unaffected by water and weather conditions.

BITU-MINERAL CEMENT

Shows its superiority in the "how" and the "where" of the making. That is, every gallon of Bitu-Mineral Cement is manufactured with the greatest care by the most modern and scientific method.

BITU-MINERAL CEMENT

Enables contractors in all parts of the country to build the most durable bituminous streets at proper, not unreasonable prices. Contractors and municipal authorities should write and learn of the unhampered opportunities they now have to build Bitu-Mineral and other approved forms of bituminous macadam pavements at a minimum first cost.

NATIONAL BITUMEN COMPANY
INDIANAPOLIS, INDIANA

MAKES A

NOISELESS BRICK PAVEMENT

Sarco is an elastic, rubbery filler which prevents wear on the edges and corners of the brick. Increases the life, decreases maintenance cost.

Standard Asphalt and Rubber Co.

First National Bank Bldg., Chicago

NEW YORK CITY PITTSBURG, PA. KANSAS CITY, MO.

Aspinwall Avenue, Brookline, Mass., made Dustless with "Tarvia A"

Durable Roads

The Tarvia, or tarring process of making macadam roads dust-proof, is almost as standard today in America as it is in France. Oils and water-mixtures which keep down the dust after it is formed are now giving way to tar, which prevents the development of dust.

Tarvia is applied in liquid form and hardens after it has penetrated the top surface—forming an elastic, water-proof blanket over the whole road. Macadam so treated is dust-proof. For the entire season it will resist the wear of automobile travel without pulverizing and, except in extreme cases, without sprinkling.

"Tarvia B," the new Tarvia material, can be economically applied cold from a sprinkler after the manner of oil. The road is cleaned beforehand, and receives a sprinkling of sand afterwards. Such treatment costs about $300 a mile to apply, and not only acts as a binder, but makes the road shed water instead of absorbing it. Hence the frequently renewed top layer of fine crushed stone or sand, which is now used, may be dispensed with on macadam roads that have been treated with "Tarvia B." The unprotected 1½-inch stone will present in some cases a rougher and less sightly surface than the usual screenings, but the fine stone or sand is the source of much dust, and cannot be kept on the road, whereas the larger stone will not produce dust and will endure much longer.

For the finest macadam roads in parks and boulevards for instance, and for new roads, we recommend "Tarvia A," or the heated treatment. This heating requires some extra labor and expense, but it makes the ideal binder for a top dressing, and the finished road will resemble asphalt in appearance and character and presents dustless macadam at its best.

BOOKLETS ON REQUEST

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"HIGH GRADE NATURAL ASPHALTS"

FOR PAVING AND ROOFING PURPOSES

EXCEL THE ARTIFICIAL
UNAFFECTED BY WATER
AS SHOWN IN ACTUAL USE

Wears Longer Than Man-Made Asphalts and Coal Tar

THE A. L. BARBER ASPHALT COMPANY THE WEST STREET BLDG. 90 WEST ST., NEW YORK

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SOLD BY THE FOOT!

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WATERPROOFING FABRIC

IT IS AN
ASPHALTED
TEXTILE

MANUFACTURED ONLY BY
THE SICILIAN ASPHALT PAVING CO.
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GABRIEL & SCHALL
205 PEARL ST., NEW YORK
Sole Importers of the only
Genuine "Brunswick" Asphalt Mastic
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Our "Brunswick" is branded as here shown.

All Others are Imitations

BRUNSWICK G.&S. GERMANY

ALSO IMPORTER OF HIGHEST GRADE OF
Soft
BITUMEN

Well Known for 25 Years

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SUCCESSFULLY USED OVER TEN YEARS

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Every subscriber to Municipal Engineering is invited to use our question department. We give you the benefit of the most authoritative information obtainable.

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WHEN YOU USE

TEXACO PAVING CEMENT

The Most Stable Asphalt Under Climatic Changes
Uniform and Pure—Ensures Accurate Work

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GOOD PAVEMENTS PROPERLY CONSTRUCTED SAVE MONEY

Our printed matter contains important paving facts. Write for it today.

There is real economy in a good pavement properly laid. That is why it pays to have your work done by paving specialists. Our long practical experience in all kinds of paving work enables us to produce the best pavement possible out of the material you wish to use. We make a specialty of BITULITHIC but will gladly furnish bids on any material desired.

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Capacity—40,000 tons per year. 99.6 per cent. bitumen.

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CALIFORNIA ASPHALT

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Samples and prices furnished to responsible parties not connected with the Asphalt trust.

Address all inquiries,
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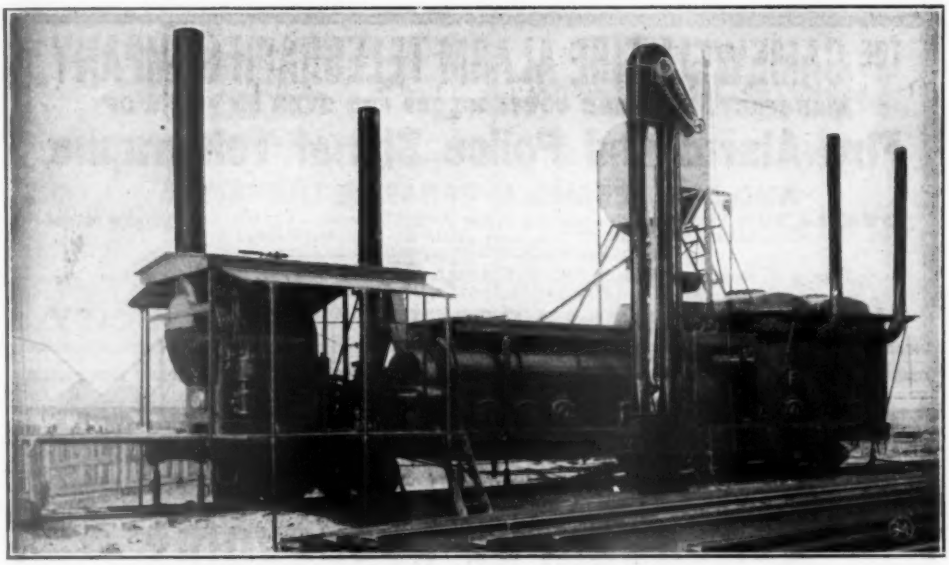

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The Only Profitable Portable Plant Proposition

Complete on One Car

Selling fast as we can turn them out. No failures.
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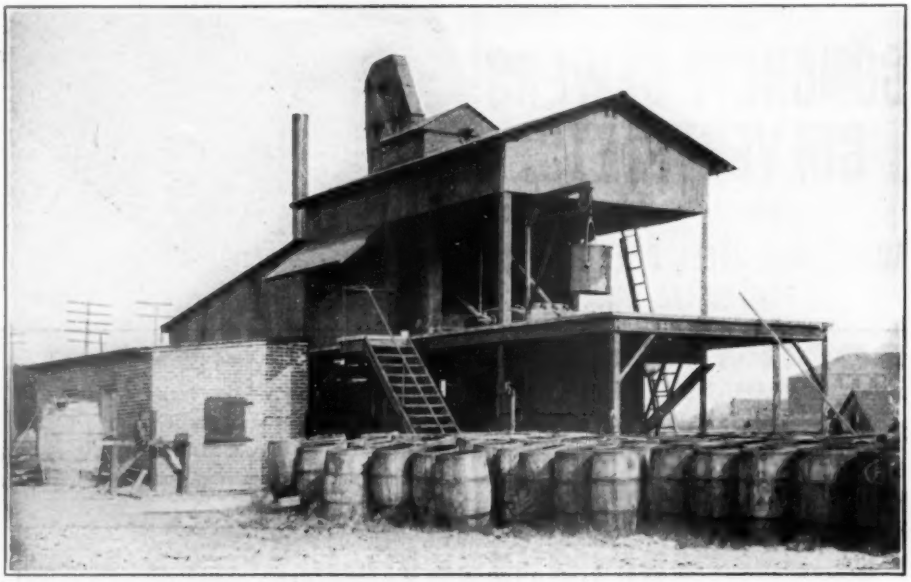

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Here is a Little Wonder. Five Hundred Yards per Day Capacity for Patching

When you deal with us you get from **First Hands.** We own and operate our own steel works, foundry, pattern shop and machine shops. We have facilities and experience not to be found elsewhere

You Pay ONE PROFIT. Cheapest as well as BEST. All Kinds and Any Capacity

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MANUFACTURERS AND CONTRACTORS FOR OVER 50 YEARS OF

Fire Alarm and Police Signal Telegraphs

AND FOR SPECIAL APPARATUS THEREFOR.

OVER 1,300 Plants in actual service in the United States and Canada. Plants also established in Cuba, Philippine Islands, South America, Germany, Hawaii, West Indies, England, Norway and South Africa.

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WRITE FOR OUR BULLETIN ON THE DESIGN OF

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YOU WILL FIND IT USEFUL AND INTERESTING

Formerly Expanded Metal and Corrugated Bar Co.

CORRUGATED BAR COMPANY
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Adjustable Steel Centers

FOR MAKING

CONCRETE SEWERS CULVERTS, ETC.

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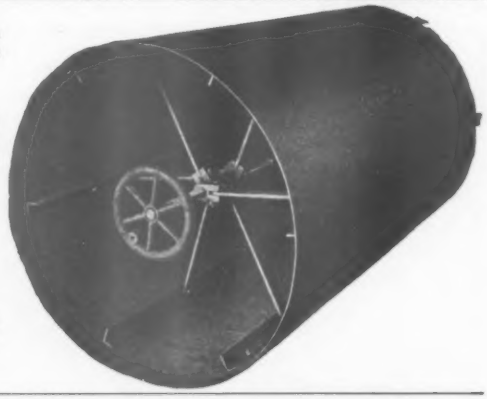

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99 PER CENT. PURE BITUMEN Refined from liquid asphalt to any consistency required

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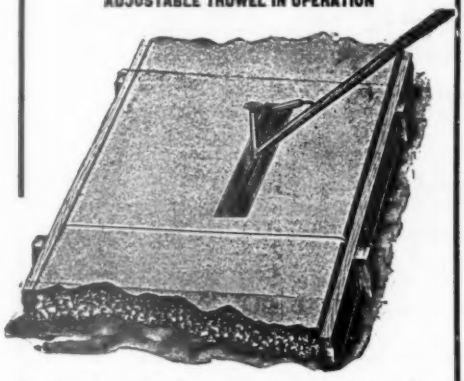
"I AM FOR SIDEWALK MEN"

Lack of experience will not interfere with you finishing a walk in first-class shape if you use me

ADJUSTABLE TROWEL IN OPERATION



Send for Catalogue of Connelly's Adjustable Cement Finishing Tools

showing cuts of five other practical tools that fit the adjustable handle, namely: Edger, jointer, pointing trowel, and a combination curbstone finisher. We make special mention of the curbstone finisher, as it is the only one of its kind that in one operation completely finishes the curb, cuts the curb joint and turns the edge, thereby doing away with all previous operations. Address all communications to

P. F. CONNELLY :: El Reno, Oklahoma

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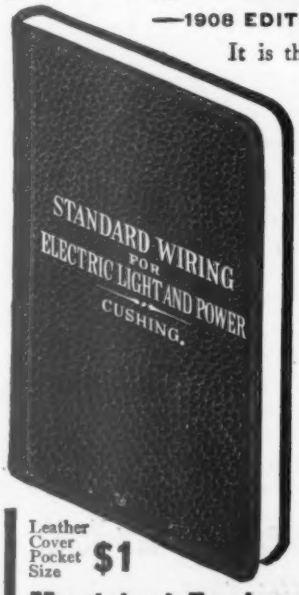
—1908 EDITION—



It is the only book on electric light and power wiring kept strictly up to date. It contains every rule, table and formula for every class of wiring. It settles disputes, and, if referred to before wiring, prevents disputes.

Leather Cover Pocket Size **$1**

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Indianapolis, Ind.

A DAMAGE SUIT

Is Not a Very Pleasing Prospect

Here is a case in point:

A heavy automobile (and they are making them heavier every year) is speeding along one of our "good roads" when suddenly it plunges into an open ditch.

A "broken culvert," or a "washed out fill," is the cause assigned in the newspaper reports.

In either case property is destroyed and probably life is sacrificed, and a suit for damages is entered against the Township, County or State.

It may be the culvert was of **WOOD** and *rotted* out, or of **CLAY** and *crumbled*, or of **SHEET METAL** and *rusted* out or *choked* up, bringing undue pressure of water on the fill.

Expert Engineering testimony will be sought to determine whether either of these materials was the *best* that could have been used, and—you know what that testimony would be.

My short length Cast Iron Pipe will neither **Rot, Crumble, Rust** nor **Choke.**

It is smooth *inside* (where smoothness is required) and the spiral ribs on the outside firmly anchor it into the fill.

You may be using other kinds of culverts now, but sooner or later you will *replace* them with *cast iron.*

Why not secure a "Casualty Insurance Policy" by using my short length, spiral ribbed, Cast Iron Pipe in the first place, and forget all your "culvert troubles"?

It is *light* and *strong.*

"The reason is in the ribs."

LET ME QUOTE YOU PRICES

R. C. McWANE

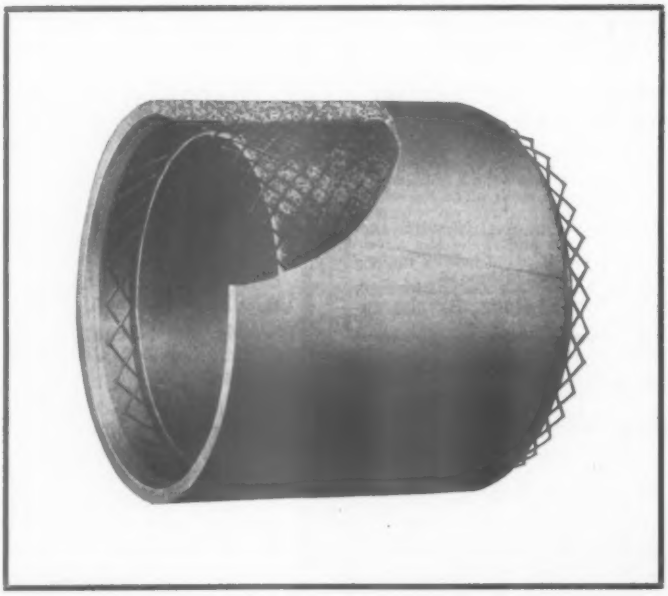
St. Paul Building, - NEW YORK CITY

MERIWETHER SYSTEM

CONTINUOUS CONCRETE PIPE

(REINFORCED)

SEWERS, CULVERTS CONDUITS



The only concrete pipe having continuous and uniform reinforcement throughout entire line of pipe when it is laid in the trench.

Joints locked and sealed from interior of pipe, giving continuous invert and absolutely tight joints.

The only pipe made which can be sealed and locked after placing backfill, thereby insuring tight joints.

The only pipe having uniform section of metal and concrete after laying.

SIZES, 24 INCHES TO 72 INCHES

WRITE FOR ADDITIONAL INFORMATION

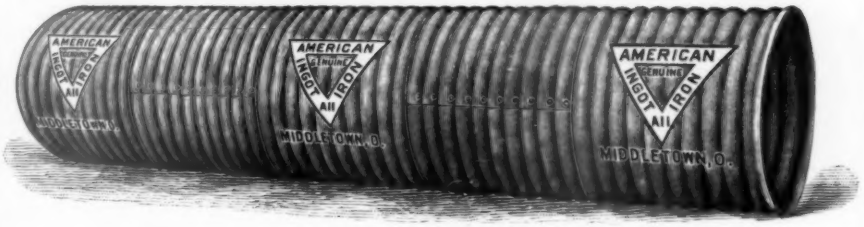
LOCK JOINT PIPE COMPANY, 165 Broadway, New York

PACIFIC LOCK JOINT PIPE COMPANY, SEATTLE, WASH.

STEEL RUSTS IN THE GROUND BUT CORRUGATED METAL CULVERTS MADE FROM

AMERICAN INGOT IRON

RESIST CORROSION



NONE GENUINE WITHOUT THIS TRADE-MARK ON EACH SECTION

WRITE FOR BOOKLET "ME" ON
"AMERICAN INGOT IRON RUST RESISTING PLATES"

The AMERICAN ROLLING MILL COMPANY

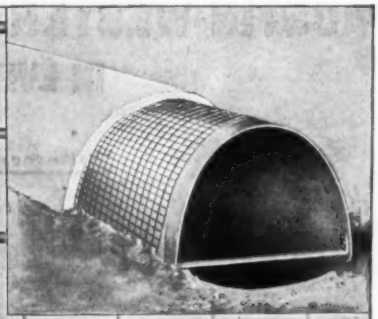
500 Grand Avenue, MIDDLETOWN, OHIO

RIB METAL

For Reinforced Concrete

SEWERS

Bent in Shops to any Curve



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LABOR SAVER IN PLACING

One of the KAHN SYSTEM Products

TRUSSED CONCRETE STEEL Co

621 TRUSSED CONCRETE Bldg DETROIT MICH

Browning Locomotive Cranes

Are useful everywhere because they can do all kinds of work

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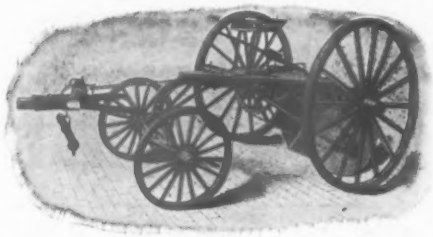
The BROWNING ENGINEERING CO., Cleveland, O.



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merit the widespread approval given them:
they are *dependable* in every respect

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AUSTIN-WESTERN ROAD MACHINERY

IN EVERY CORNER

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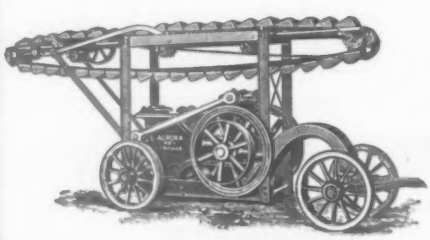
THE AURORA JAW CRUSHER HAS FEWER PARTS
than any other crusher of similar capacity, consequently
THE AURORA NEEDS FEWER REPAIRS

STRENGTH + LIGHTNESS + SIMPLE DUMPING DEVICE =
AUSTIN DUMP WAGON



A WORD OR TWO ABOUT STRENGTH
A BRIEF THOUGHT ABOUT REPAIRS
A SUGGESTION REGARDING EASY DRAFT

Thoughts for the Man Buying Dump Wagons

If you doubt that Adirondack Birch makes the strongest body for dumping wagons, if you think that other spokes are as good as the second growth, 'A' grade, White Oak spokes we use—just ask men who have used different makes of dump wagons alongside of WATSON'S.

Accidents put Watson Dump Wagons out of commission sometimes—heavy work rarely affects them. All you need in Watson repairing is two hands, a monkey wrench and duplicate part—no long wait at a blacksmith shop.

On the XL Watson Wagon shown here, the design of the front circle will commend itself to you. Easiest draft of any dump wagon in the world.

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WATSON WAGON COMPANY
CANASTOTA, N. Y.

Chicago Branch Office, 99 Randolph St. Branch Offices in N. Y. City, Philadelphia, Pittsburg and other cities

Studebaker

The Dump Wagon *of* Quality

WHY experiment continually with dump wagons you know are not up to *Studebaker* quality—quality that means better MATERIAL, better CONSTRUCTION and better SERVICE?

Material—The wood material is selected from the immense stock of 70,000,000 feet of lumber which is air dried from two to four years. The metal material is all carefully tested by expert chemists in our iron and steel laboratories.

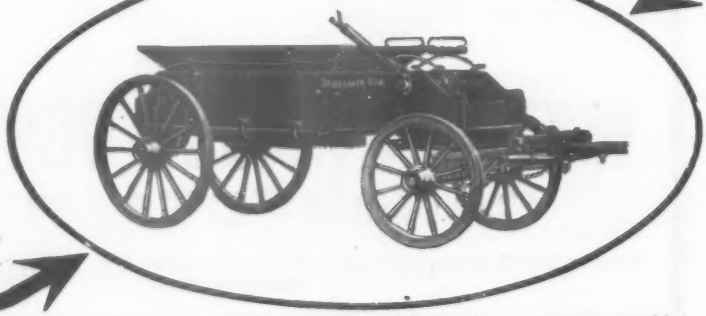
Construction—Every part of the dump wagon is made by experts. Our fifty-six years' experience in wagon construction enables us to build the best dump wagon for all classes of work that it is possible to build.

Service—Every *Studebaker* Dump Wagon gives satisfaction, because it is serviceable and dependable. The construction speaks for itself.

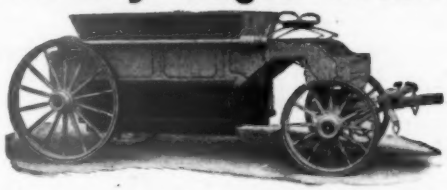
LARGEST VEHICLE WORKS IN THE WORLD

Studebaker Brothers Mfg. Co.

SOUTH BEND, INDIANA



Twenty Wagon Loads Piled on One Troy



That was, in effect, the test made at Purdue University when a Troy wagon was loaded with 36 tons! The ordinary dump wagon is seldom called upon to carry more than 1¾ tons, yet this Troy dump wagon stood up under twice ten times that load. The Troy is incontrovertibly the toughest, strongest, simplest dump wagon made. Its simplicity is apparent. Its toughness and strength will be better understood after reading a full account of the test above mentioned.

Send for the details of the test and ask for CATALOGUE NO. 2F

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A Sure Water Supply

One of the most important engineering problems of the day is the economical pumping of water and other fluids. Therefore, Compressed Air, on account of its merits, is recognized as a reliable power for pumping, embodying simplicity, economy and durability. A variety of conditions means a demand for a variety of pumping equipment. We have equipment for all conditions.

Every plant installed under guarantee
Write for Catalogue

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FIGURES NEVER LIE

BUT THE SHORTEST WAY TO THE TRUTH IS THE BEST

FOUR days at $1.25 per day equals $5.00—that's easy! But, 17 days in a 31 day month at $1,000 per year? That's different! And 19¾ hours at 37½ cents per hour? Take a pencil and paper—work it out and note how much time, paper and figures you use.

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THE FIRST MOTOR ROAD ROLLER EVER MADE IN AMERICA.

An American roller, made in an American factory, by American workingmen.

Made in Four Sizes:

7 TONS : 10 TONS : 12 TONS : 15 TONS

It can do anything and everything which the very best type of Steam Roller can do. It can do it more easily, more efficiently, more economically and less objectionably

Operated by gasoline or denaturized alcohol.

These rollers are in the service of Counties, Cities, Townships, Villages, and Road Contractors from the ATLANTIC to the PACIFIC, from CANADA to MEXICO.

They have reduced cost of operation on an average 30 per cent. and show *maximum efficiency* in work done.

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Steam Rollers & Asphalt Mixers.

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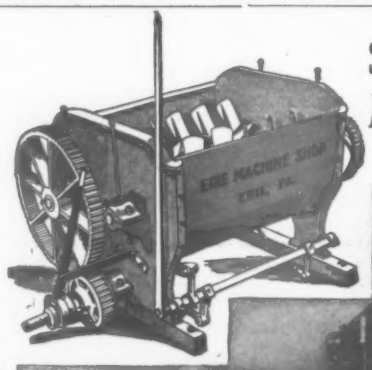
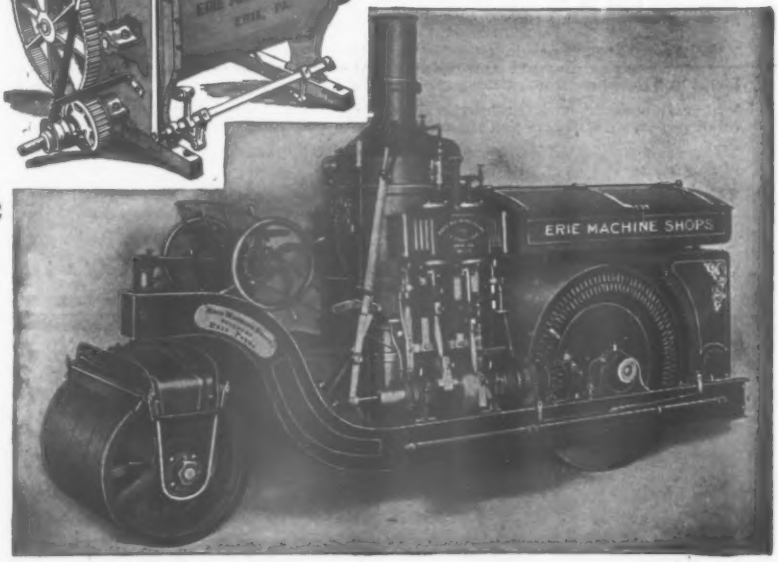
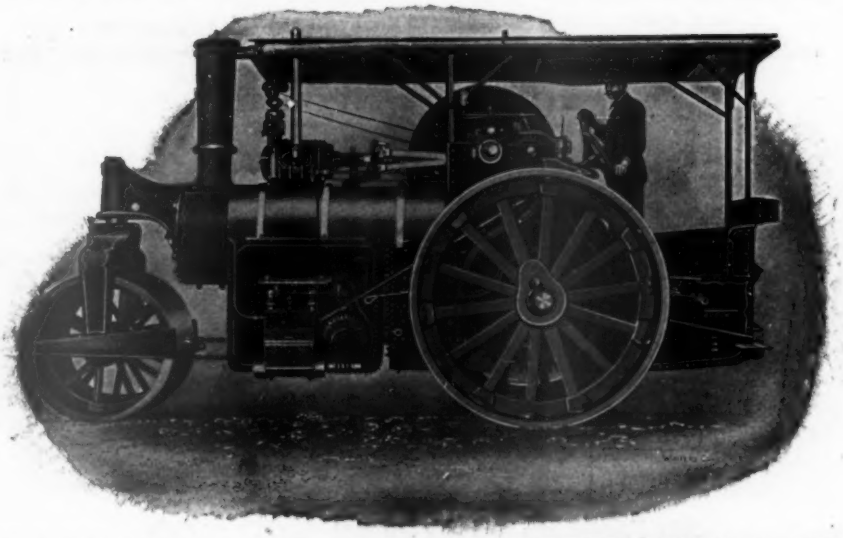




Erie Machine Shops { P. W. DIETLY, Proprietor. Cor. 13th and Peach Sts., ERIE, PA.

THE KELLY-SPRINGFIELD ROAD ROLLER CO.



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ALL TYPES, ALL SIZES,
SATISFACTION GUARANTEED.
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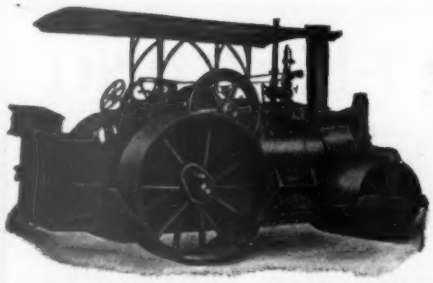

BUFFALO STEAM ROLLER COMPANY, Buffalo, N.Y.

Eastern Offices { 15 Court Square, Boston, Mass. / 150 Nassau Street, New York City

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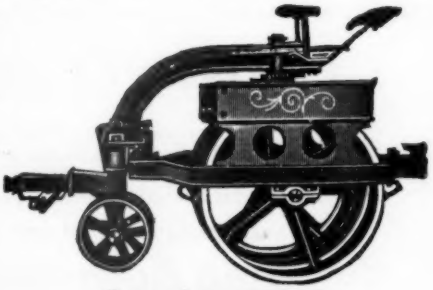
Reversible Road Roller



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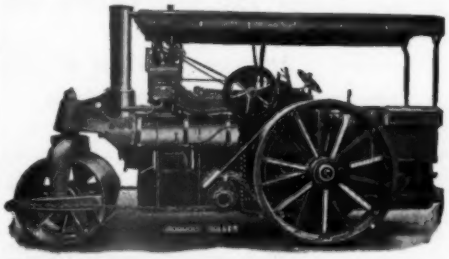

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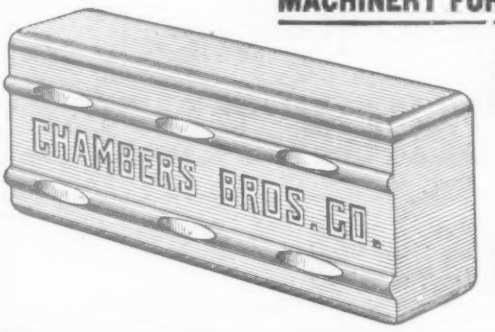

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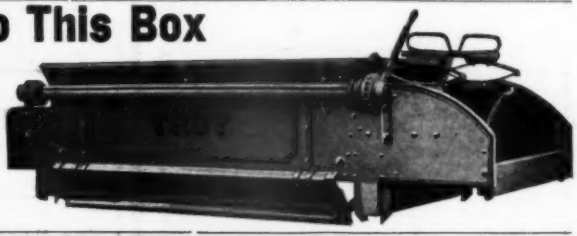

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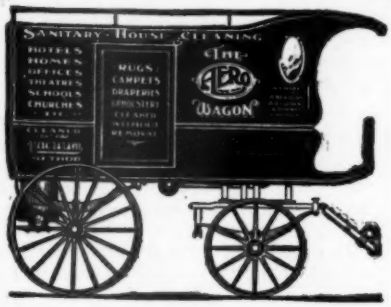

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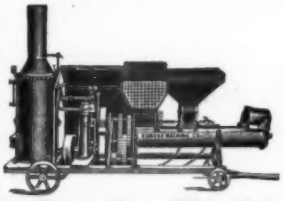

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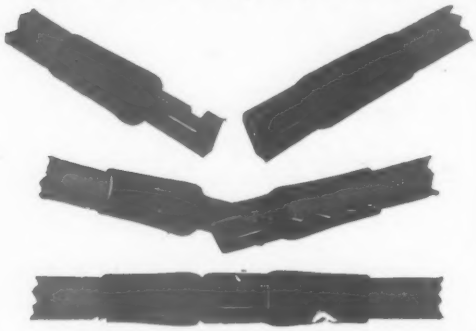

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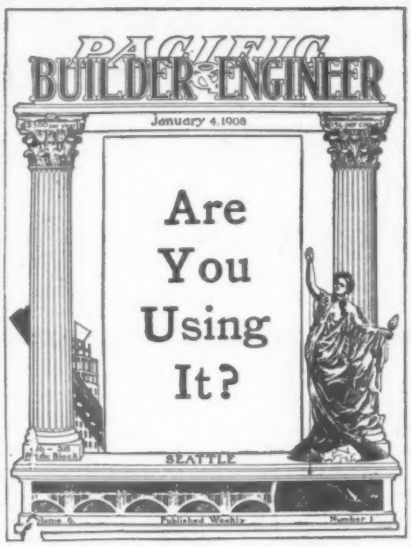

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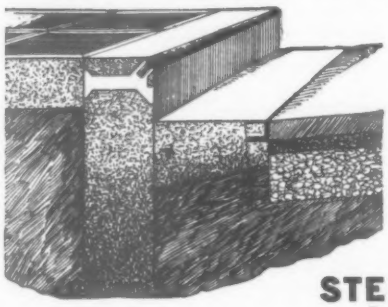

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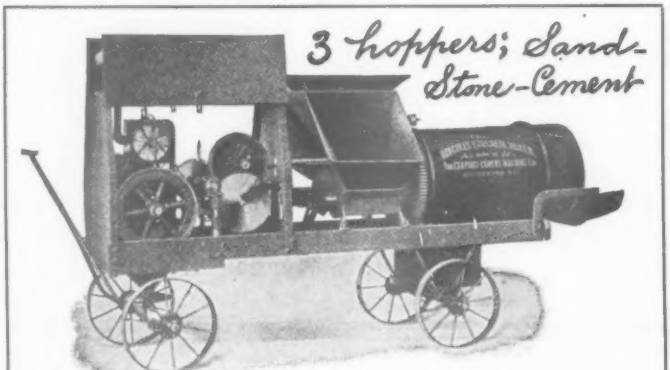

The Hercules Mixer proportions the materials *accurately*, then mixes them thoroughly. Proportions can be changed instantly without the use of *sprockets*, *chains* or *belts*. The proportioning feed once set for a given proportion cannot possibly get out of adjustment. Proportions cannot vary because it's a *forced* feed and *not a worm feed*—that's what makes it reliable.

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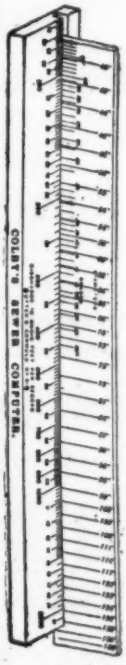

WHAT IT IS

This instrument is Kutter's formula in the form of a slide rule. The values obtained are the same as given by Kutter's formula; the value of the coefficient "N" being taken at .013. The cut shows only a portion of the entire computer. The divisions on the limb represent discharge in cubic feet per second. On the slide are two scales, the divisions of one indicate different diameters of sewers in inches; the divisions of the other represent the per cent. of grade. The computer can be used by any one after one minute's explanation.

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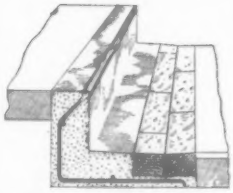

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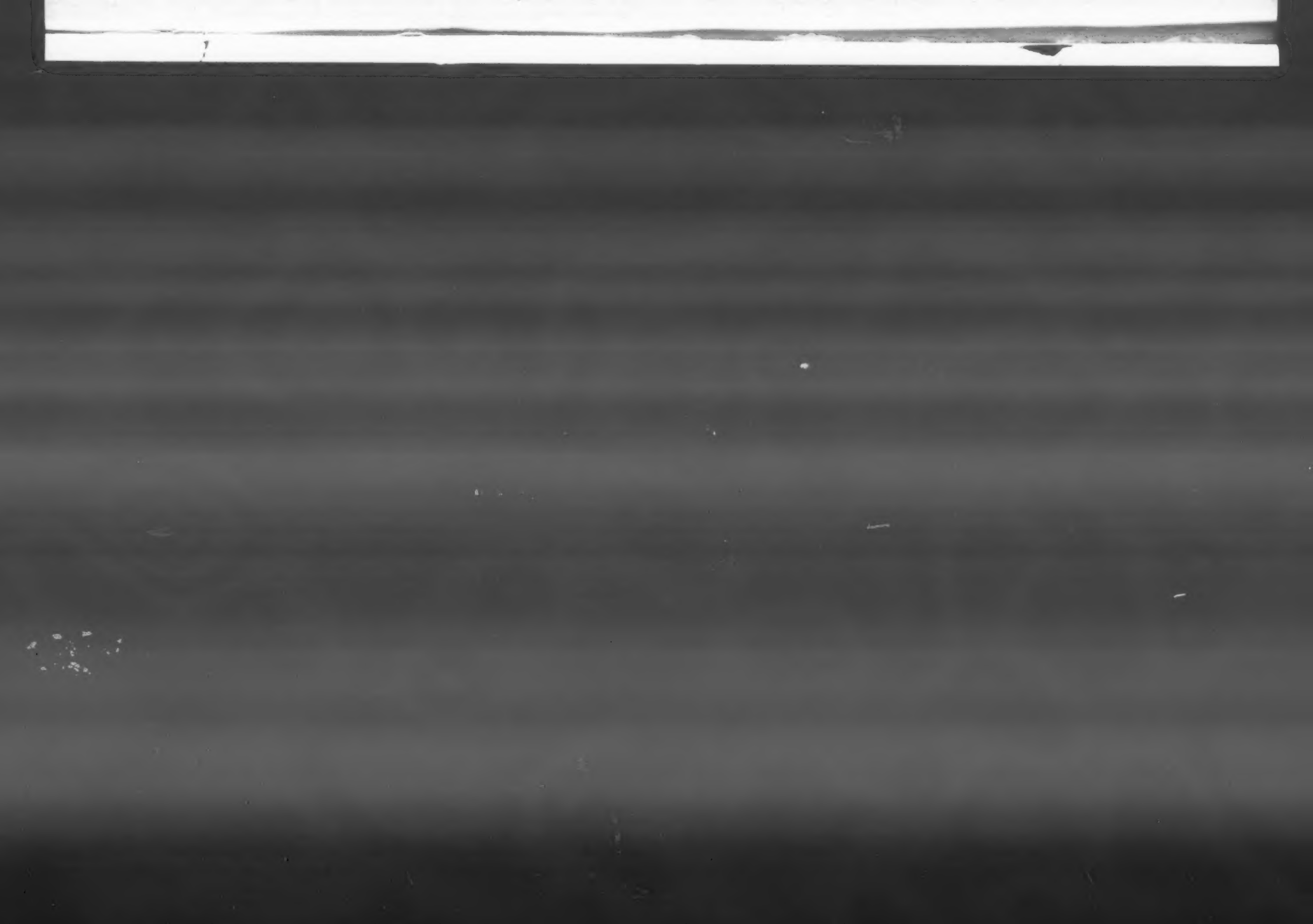

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